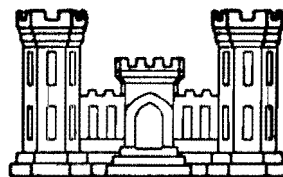


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RARITAN BAY AND SANDY HOOK BAY
NEW JERSEY

BEACH EROSION & HURRICANE PROJECT
MADISON TOWNSHIP

OPERATION AND MAINTENANCE
MANUAL



DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK, NEW YORK

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P R E F A C E

The Beach Erosion Control and Hurricane Protection Project extending along the south shore of Raritan Bay in Madison Township, Middlesex County, New Jersey, was constructed as part of the Raritan Bay and Sandy Hook Bay, New Jersey Beach Erosion Control and Hurricane Protection Project authorized by Congress in the Flood Control Act of 1962, approved 23 October 1962 (Public Law 87-874, 87th Congress) in accordance with recommendations of the Chief of Engineers contained in House Document No. 464 87th Congress, 2nd Session. It is recommended by the Chief of Engineers in House Document No. 464 that local interests shall . . . "maintain all the works after completion in accordance with regulations prescribed by the Secretary of the Army". These regulations, which apply to all local flood protection works, are contained in the Code of Federal Regulations of the United States of America, Title 33, Chapter II, Part 208, Section 208.10, a copy of which is contained in this manual as Exhibit A.

To supplement these general regulations, it is provided (subparagraph 208.10 (a) (10) of the above cited regulations) that the "War Department (Department of the Army) will furnish local interests with an Operation and Maintenance Manual for each completed project to assist them in carrying out their obligations under these regulations." In accordance with this provision, the following Operation and Maintenance Manual for the Madison Township Beach Erosion Control and Hurricane Protection Project has been issued.

OPERATION AND MAINTENANCE MANUAL
RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

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OPERATION AND MAINTENANCE MANUAL
RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
MADISON TOWNSHIP

BEACH EROSION AND HURRICANE PROJECT

I - INTRODUCTION

1. Authority. The construction of the Madison Township portion of the Raritan Bay and Sandy Hook Bay, New Jersey Beach Erosion Control and Hurricane Protection Project was authorized by Congress in the Flood Control Act of 1962 approved 23 October 1962 (Public Law 87-874, 87th Congress) in accordance with recommendations of the Chief of Engineers contained in House Document No. 464, 87th Congress, 2nd Session.
2. Location. The project is located in Middlesex County in northern New Jersey, extending along the south shore of Raritan Bay from Cheesequake Creek to Whale Creek, Madison Township (see Plate 1).
3. Description of Project. The project works extend for a distance of about 10,200 feet and consists of 1,400 feet of hurricane beach protection at Morgan Beach, 3,800 feet of bluff protection at Laurence Harbor from Morgan Beach to Seidler Beach, 2,200 feet of beach protection at Seidler Beach, 2,800 feet of bluff protection at Knollcroft from Seidler Beach to Whale Creek, structures to provide for interior drainage, and the raising and relocation of a service road north of and adjacent to New Jersey Route 35.
4. Protection Provided. The improvement works are designed to protect the shore areas of Madison Township against tidal flooding and bluff erosion and to provide beaches fronting low areas. The top elevation of 15-feet above mean sea level provided for beaches and levees will

provide protection against the maximum surge of record (10.4 feet) produced by the extratropical storm of 25 November 1950 recurring coincidental with a predicted mean high tide, including an allowance protection of about 2 feet for wave run-up. The top-elevation of 10 feet above mean sea level provided for bluff areas will dissipate the energy of waves with heights up to about 9 feet before wave action reaches the base of the bluffs. The berm elevation of 5.5 feet above mean sea level for beaches in low areas is approximately the same as the berm elevation of natural beaches in the area.

5. Construction History. Construction plans and specification for the project were issued on 18 February 1965. Bids were received on 30 March 1965 and Contract Number DA-30-075-CIVENG-65-65 dated 21 April 1965 was awarded to the Gates Construction Corporation, Foot of Industrial Avenue, Little Ferry, New Jersey, 07643. Construction work was initiated on 5 May 1965 and completed on 27 October 1966.

II - LOCAL COOPERATION

6. Requirements. The Flood Control Act of 1962, under which this project was authorized requires general items of local cooperation by local interests in accordance with the requirements of Section 3 of the Flood Control Act of 1936 as follows:

Section 3 - "That hereafter no money appropriated under the authority of this Act shall be expended on any project until States, political subdivisions thereof or other responsible local agencies have given assurances satisfactory to the Secretary of the Army that they will:

(a) "Provide without cost to the United States, all lands, easements, and rights-of-way necessary for the construction of the project, except as otherwise provided herein;

(b) Hold and save the United States free from damages due to the construction works;

(c) Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army"

In accordance with subsection (c) above, regulations for the maintenance and operation of flood control works have been prescribed and are contained in this Operations and Maintenance Manual as Exhibit A. For other items of Local Cooperation, in addition to the general requirements as provided by law, reference is made to the Assurances executed by the State of New Jersey and the Township of Madison.

7. (a) Local Cooperation. Assurances of local cooperation for the Raritan Bay and Sandy Hook Bay, New Jersey Beach Erosion Control and Hurricane Protection Project were executed by the Commissioner of the Department of Conservation and Economic Development of the State of New Jersey on 3 April 1963 and were accepted for the United States of America on 11 April 1963. Assurances of local cooperation were executed by the Mayor of the Township of Madison on 5 April 1963. A supplement to the original assurance of local cooperation was executed by the State of New Jersey on 7 June 1968.

(b) A joint inspection of the completed Madison Township project works was made by representatives of the State of New Jersey Department of Conservation and Economic Development, the Township of Madison and the

Corps of Engineers on 20 March 1967. The Commissioner of the Department of Conservation and Economic Development of the State of New Jersey acknowledged acceptance of the completed project on 25 April 1967 and confirmed previous assurances to maintain and operate the project in accordance with the regulations prescribed by the Secretary of the Army.

III - GENERAL RULES, DUTIES AND PROCEDURES

8. Purpose of this Manual. The purpose of this Manual is to present general information for assisting the responsible local interests in complying with the "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War 9 August 1944, hereinafter referred to as the Regulations. The Regulations, which compromise Section 208.10, Title 33 of the Code of Federal Regulations were published in the Federal Register of 17 August 1944 and are bound in the back of this Manual as Exhibit A. Compliance with the Regulations is one of the requirements of local cooperation. As written, the Regulations are general in nature and obviously cannot give detailed instructions for the maintenance and operation of a specific project, but failure to maintain and operate the project as required by the Regulations may cause severe property losses and loss of life and can result in a loss of confidence in the protective works by those whose interests are involved. Upon establishment of the Department of Defense the improvement of rivers and harbors and other waterways for flood control and other purposes, formerly under the jurisdiction of the Secretary of War, became the responsibility of the Secretary of the Army. Reference in the Regulations to the Secretary of War and the War Department shall be construed to mean, respectively, the

Secretary of the Army and the Department of the Army.

9. General Rules and Procedures. General rules for operation and maintenance of structures and facilities of local flood protection works are stated in Items 1 through 10 under paragraph (a) of the Regulations (Exhibit A). Further details and suggestions for complying with these requirements are contained in this section of the Manual.

10. The Superintendent and His Duties. (a) The Regulations provide that the responsible local agency " . . . shall appoint a permanent committee consisting of, or headed by, an official hereinafter called the Superintendent, who shall be responsible for the development and maintenance of and directly in charge of, an organization responsible for the efficient operation and maintenance of all structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water" The Commissioner, Department of Conservation and Economic Development, State of New Jersey located at the Labor and Industry Building, John Fitch Way Plaza, Trenton, New Jersey, Telephone Area Code 609, 292-2885 has been designated as the Superintendent of the Raritan Bay and Sandy Hook Bay, New Jersey, Beach Erosion and Hurricane Protection Project at Madison Township, New Jersey. The superintendent's alternate is Mr. James K. Rankin, Chief Engineer, Navigation Bureau, Department of Conservation and Economic Development (same address as the Commissioner), Telephone Area Code 609, 292-2652. Mr. Rankin, in a letter dated 21 March 1967, indicated that in view of the cooperative nature of the project and the full partnership

of Madison Township with the State of New Jersey, much of the responsibility for operation and maintenance of the Beach Erosion and Hurricane Protection Project will lie with the Township Engineer, the Township police department, and the Township Public Works Department under direction of the Mayor of the Township of Madison.

(b) Competent and responsible men for staffing of key positions to handle all contingencies in an efficient manner is essential. Such key personnel should be familiar with physical features of the protective works and be fully aware of their responsibilities pertinent to operation and maintenance of the project.

(c) Drawings or prints of proposed improvements or alterations to the sand fill, levee, drainage facilities or appurtenant structures as required by paragraph (a) (5) of the Regulations (Exhibit A) should be submitted in triplicate to the District Engineer through the Chief, Operations Division, Department of the Army, New York District, Corps of Engineers, 26 Federal Plaza, New York, N. Y. 10007, Telephone Area Code 212, 264-9020, sufficiently in advance of initiation of proposed construction to permit adequate study and consideration of the work involved. Drawings in triplicate, or reproducible prints showing any improvement or alterations as finally constructed and photographs depicting conditions before and after repair should be furnished the District Engineer upon completion of the work.

(d) The Superintendent should make permanent arrangements to secure forecasts of tidal stages and weather conditions in the project area. The official Federal forecasting agency in New Jersey is the Environmental

Science Services Administration (U.S. Weather Bureau) located in Trenton, New Jersey, Telephone Area Code 609, 396-8891. A Weather Bureau teletype receiver whereby weather conditions and forecasts for the project area can be obtained is located in the Office of the Marine Police at the Monmouth Beach State Marina, Monmouth Beach, New Jersey, Telephone Area Code 201, 229-6000. Tide gages in the project area are listed in Exhibit D of this manual. Tidal stages at Fort Wadsworth, Staten Island, N. Y. may be obtained from the Survey Branch, Operations Division, New York District, Corps of Engineers, 26 Federal Plaza, New York, N. Y. 10007, Telephone Area Code 212, 264-0180. A directory of personnel is contained in Exhibit L of this Manual. The Superintendent should check addresses and phone numbers periodically and make necessary revisions.

11. Periodic and Annual Inspections. The Regulations (Exhibit A) require that periodic inspections be made at the following times:

- (a) Immediately prior to the beginning of the flood season.
- (b) Immediately following each major high water period.
- (c) Otherwise at periods not exceeding 90 days.

(d) At such intermediate times as may be necessary to insure the best possible care of the flood protection works. It is essential that all facilities including levees, beach protection and drainage structures be inspected and necessary repairs accomplished prior to the hurricane season (August through October) and the winter season. Once a year, at a mutually agreeable time, a joint inspection attended by representatives of the responsible local agencies and the Corps of Engineers will be conducted. The purpose of the annual inspection is

to assure that adequate and timely maintenance is being accomplished and to furnish technical assistance when required.

12. Check Sheets. To facilitate inspection, either routine or emergency, there are suggested forms of report sheets shown in Exhibits E through K of this manual. These, or similar forms, should be used at each inspection to insure that no feature of the protective system is overlooked. Any item requiring repairs should be noted thereon and satisfactory items should be indicated by a check. Appropriate notations regarding the condition of drainage structures should be made at the time the drainage gates are inspected.

13. Periodic Reports. A semi-annual report required by paragraph (a) (6) of the Regulations (Exhibit A) and a report after any major storm are to be submitted by the Superintendent to the District Engineer through the Chief, Operations Division, Department of the Army, New York District, Corps of Engineers, 26 Federal Plaza, New York, N. Y., 10007. Such reports should cover inspection, maintenance and operation of the protective works and should include dated and signed copies of inspection check lists or report sheets made during the period covered by the report. In the event that repairs have been made, either temporary or permanent, the nature and dates of construction are pertinent and should be included. Photographs should be included depicting conditions of the project works before and after repair or replacement of material. The semi-annual report should be completed and transmitted during the latter part of December and June, unless the Superintendent desires to arrange for other dates of submission, and should include all operation and maintenance performed during the preceding 6 months.

IV - BEACH PROTECTION

14. Description of Sand Fill As Designed. (a) Morgan Beach. The hurricane beach protection at Morgan Beach consists of hydraulically placed sand fill extending for a distance of about 1,400 feet from Station 8+00 to Station 22+00 along the south shore of Raritan Bay (See Plate 1). The top elevation of the sand fill dike is 15 feet above mean sea level and the design berm width is a minimum of 25 feet, with design slopes of 1 on 20 on the bay side and 1 on 15 on the protected side. Beach grass has been placed on the protected side of the sand fill dike. The easterly closure of the sand fill dike is the existing bluff and the westerly closure is an earth levee (described in Section V of this manual) which extends generally south 500 feet to a service road located north of and adjacent to New Jersey Route 35. The sand fill dike is wrapped around the end of the earth levee to provide protection against erosion from wave action.

(b) Laurence Harbor (Morgan Beach to Seidler Beach). The bluff protection from Morgan Beach to Seidler Beach consists of hydraulically placed sand fill to elevation 10.0 feet above mean sea level extending for a distance of about 3,800 feet along the south shore of Raritan Bay from Station 22+00 to Station 60+00 (See Plate 1). The design slope is 1 on 20 on the bay side with a minimum berm width of 25 feet which butts against the existing high bluff.

(c) Seidler Beach. The beach protection at Seidler Beach consists of hydraulically placed sand fill to elevation 5.5 feet above mean sea level extending for a distance of about 2,200 feet from Station 60+00 to Station 82+00 along the south shore of Raritan Bay from the vicinity of Margaret Creek to the vicinity of the Madison Township sewage disposal plant (see Plate 1). The design slope is 1 on 20 on the bay side with a minimum berm width of 100 feet butting against high ground at elevation 5.5 feet above mean sea level.

(d) Knollcroft (Seidler Beach to Whale Creek). The bluff protection at Knollcroft consists of hydraulically placed sand fill to elevation 10.0 feet above mean sea level extending for a distance of about 1,200 feet from Seidler Beach at Station 82+00 to Station 94+00 (See Plate 1). The design slope in this reach is 1 on 20 on the bay side with a minimum berm width of 25 feet which butts against the existing high bluff. From Station 94+00 to Station 105+82 for a distance of about 1,182 feet a transition is made to a section consisting of a 1 on 20 slope to elevation 5.5 feet above mean sea level, thence a 100 foot wide berm, thence a slope to elevation 10 feet above mean sea level, thence a minimum 25 foot berm butting against the existing high bluff. This beach section provides bluff protection as well as beach replenishment and protection. The remaining bluff protection consists of hydraulically placed sand fill to elevation 10.0 feet above mean sea level extending for a distance of about 418 feet from Station 105+82 to Whale Creek at Station 110+00. The design slope is 1 on 20 on the bay side with a minimum berm width of 25 feet which butts against the existing high bluff. A 4 foot high wood picket sand fence has been provided along the

beach protection from Station 94+00 to Station 111+10.

(e) Beach fill sections as designed and as-built are shown on record drawings CC-RS-213 through CC-RS-215.

15. Maintenance. The Superintendent shall provide such maintenance as may be required to insure serviceability of the berm and beach in time of hurricane or other severe storms in which above normal tides may be generated. The berm and beach shall be restored to original elevations and nourished with new material to repair erosion caused by wind or wave action. Beach grass shall be fertilized and maintained so as to provide maximum effectiveness against erosion and to promote stabilization and build up of the beach. Sand fences shall be kept in an upright position and in serviceable condition. Care should be taken to insure that the beach and berm are not encroached upon. Unauthorized construction, storage of equipment, unauthorized vehicular traffic and refuse dumping shall not be permitted on the beach. A sample check sheet to be used for inspection of the beach and berm is contained in Exhibit I of this manual.

V - LEVEES

16. Location. The earth levee portion of the hurricane beach protection is located on the south shore of Raritan Bay at Morgan Beach, Madison Township, and extends generally south from the westerly end of the sand fill dike portion of the hurricane protection (described in Section IV of this manual) at station 11+00 for a distance of about 500 feet to a relocated and raised service road located north of and adjacent to New Jersey Route 35.

17. Description of Levee. The earth levee has a wide berm on both the bay and protected sides which varies to a maximum of about 200 feet. The berm intersects the existing ground surface on the bay side with a 1 on 2 design slope. The top elevation of the berm varies from 8.0 to 8.5 feet above mean sea level. On the bay side the transition from the earth levee to the sand fill dike is accomplished by a warped surface for a distance of 140 feet. The sand fill dike has a 1 on 20 slope on the bay side. Above the berm, the levee side slopes are 1 on 3 and the crown width is 25 feet. The top of the levee is at elevation 15.0 feet above mean sea level at the junction with the sand fill dike (Levee Station 0+00) and stays constant to Levee Station 4+80L and then slopes on a warped surface to elevation 15.26 feet above mean sea level at the shoulder of the service road. The core of the levee is extended through the service road and ties into an I-wall adjacent to the service road and which extends eastward for a distance of 385 feet. The entire levee is surfaced with 4 inches of topsoil and seeded. The levee embank-

ment is constructed with a core of impervious material and an outer shell and berm of random pervious material.

18. Foundation. The levee portion of the hurricane beach protection is founded on an 8 foot layer of sandy soil lying on a 70 foot layer of clayey silt overlying a sandy base. Because of the thin layer of sandy soil lying on a deep layer of permeable clayey silt and the type of borrow material which was available, a complete cutoff against seepage through the foundation was not feasible. In order not to disturb the stability conditions of the existing foundation, and utilize the available borrow, a center core of impervious material is provided through the berm material extending two feet into the existing sand layer. Considering the duration of high water, the length of seepage path and low permeability of the remaining thin layer of sand below the cutoff and above the clayey silt, it is considered that the seepage is reduced to a tolerable amount that can be accommodated in the interior drainage design.

19. Maintenance Standards. The pertinent requirements for maintenance of levees are stated in paragraph (b) (1) of the Regulations (Exhibit A) and are generally self-explanatory. These requirements pertain to the levee portion of the hurricane protection. Should inspections, either periodic or otherwise, disclose conditions that are potentially dangerous, immediate corrective measures should be taken. A suggested form of check sheet for reporting conditions found during inspections is presented in Exhibit H.

The levee will be maintained as necessary to insure serviceability against floods at all times. Standards for accomplishing the foregoing are as follows:

- (a) A good growth of sod will be maintained where feasible with grass height from 2" to 12", substantially free of weeds.
- (b) The embankment will be maintained to essentially the design grade and section by necessary correction of washes, slides and settlements.
- (c) All brush, trees or other undesirable wild growth will be removed from the levee embankment. Vegetation specifically planted for aesthetic or recreational purposes may remain.
- (d) The levee section will be maintained free of all types of animal burrows.
- (e) The levee will be maintained free of debris and drift, and other encroachments such as buildings, structures and refuse dumps. Excavation in the vicinity of the levee will be prohibited. Excavation near the levee toe in particular endangers the safety of the levee and may be conducive to formation of sand boils on the landward side of the levee.
- (f) Roads and ramps will be maintained free of ruts, pockets and washes, and in good serviceable condition.
- (g) All levee facilities and appurtenances shall be maintained in a good state of repair and in good operating condition. Particular attention should be given, where applicable, to the following:

- (1) Drainage structures through the levee.
- (2) Toe drainage systems.
- (3) Relief wells.
- (4) Levee slope protection and protection on dike ends.
- (5) Gates, cattle guards, and fences.
- (6) Closure structures for highways and railroads.
- (7) Siphons and pipe crossings.

20. Maintenance Procedures. (a) Maintaining Sod Growth. Maintenance of a sturdy sod growth on levee embankments is highly important as sod is one of the most effective means of protecting the levee against erosion from rain, and wavewash. Periodic mowing is essential to maintaining a good sod growth, and should be done at such intervals as necessary to keep down weeds and other noxious growth and to prevent the grass height from exceeding 12". The grass should be mowed to a height of 2" or more. The number of mowings required each season will depend on local conditions, but experience has indicated that in most parts of the United States two or more mowings are necessary each season where pasturing is not used. The last mowing of the season should be accomplished under conditions which will allow the grass to obtain a height of approximately 8" to 10" going into the winter season. Mowing should be performed to a distance of at least 5 feet beyond the toe of the levee or berm. Barren spots should be re-seeded or resodded as soon as practicable. An organized pasturing program is effective in developing and maintaining a good sod growth on levees. Sections of levee may be leased to adjoining land owners or others for

pasturing in accordance with applicable regulations. The lease should include provisions which protect the levee from overgrazing, insure care of the levee embankment, and prohibit any operations or encroachments which would be detrimental to the sod covering or the embankment. Pasturing must be supplemented by mowing or herbicidal treatment as necessary to destroy weeds before their seeds mature. Burning grass and weeds will not be permitted in the levee maintenance program, except during appropriate seasons when it will not be detrimental to the growth of sod. Spraying with herbicides as needed during the growing season is permissible and desirable for weed and brush control on the levee and berm. Herbicides should be used in accordance with state laws and regulations only after thorough investigation of their applicability and assurances against adverse effect on surrounding areas.

(b) Maintaining Earth Embankments. Levels should be run periodically. Where settlement is observed levee embankments should be restored to not less than the design grade and section by replacing any loss of material from the crown or slopes. Ruts, washes, slides and subsidences should be promptly repaired and the entire embankment maintained sufficiently smooth for power mowing. The levee crown should be graded as necessary to drain freely and prevent impoundment of rain water. In no instance should mowing equipment or automobiles be allowed on the levee when the ground is soft. Restoration of settled portions of the levee to design height during non-emergency periods requires coordination with the Corps of Engineers to assure that repair materials are comparable to those used in original construction.

(c) Elimination of Animal Burrows. The levee and adjacent landward areas should be maintained free of animal burrows. Animal burrows, when found, should be backfilled with compacted material. To prevent re-occurrences, efforts should be made to exterminate the burrowing animals.

(d) Prevention of Encroachment. Care should be taken to assure that the levee is not encroached upon. Buildings, structures, and storage of miscellaneous materials or equipment should not be permitted on the levee. Refuse dumps are an item of frequent concern and should not be permitted. Drift which has been deposited on the bay side of the levee should be removed promptly.

(e) Roads and Ramps. Access roads to and on the levee, including ramps, should be bladed as necessary to keep the roadway shaped properly and free of ruts, pockets and washes. Ramp embankments should be maintained to their net section and design grade. Maintenance as necessary should be performed to correct any encroachment into the levee crown where roads cross the levee. Road surfacing material should be replaced as necessary to maintain the road surface in good condition.

(f) Maintenance of Miscellaneous Levee Facilities and Appurtenances. Miscellaneous levee facilities and appurtenances which are constructed on, over or through the levee should be maintained in a good state of repair and/or in good operating condition. The condition of these facilities should be inspected at intervals indicated in paragraph 11 of this Manual.

21. Operation. Among the requirements for operation of levees contained in paragraph (b) (2) of the Regulations (Exhibit A), the provisions for continuous patrol during periods of flood is of utmost importance. Although the levee is designed to be stable under all conditions, unforeseen contingencies may arise. The men on patrol should be alert and observant during their rounds of inspection to locate possible sandboils or unusual wetness in the landside slope, indications of slides and sloughs developing, wave wash or scouring action. Appropriate measures should be taken to insure the availability of adequate labor and materials to meet all contingencies and immediate steps should be taken to repair damaged sections to prevent any conditions which may endanger the levee. Suggested methods for control and handling of emergency repairs of damaged levees are contained in section VIII of this Manual.

VI - DRAINAGE STRUCTURES

22. Description of Drainage Structures. Surface runoff in the project area prior to the building of the protective works was carried off by a system of storm drains emptying directly into Raritan Bay. These drainage facilities were altered to meet project requirements. In general all existing drain conduits were extended into Raritan Bay through the improvement works with pipes equal or greater in size than the existing conduits. Interior drainage on the land side of the earth levee portion of the hurricane beach protection is accommodated by a gravity culvert provided with an automatic drainage (flap) gate to prevent damage due to backwater from Stump Creek. In order to provide positive protection the gravity culvert is provided with a manually operated sluice gate located in a control manhole. Locations of the various drainage structures in the protective works are shown on Plate 1 of this manual and other data pertinent to the drainage structures are contained in Exhibit B. Identification numbers for the various drainage structures listed in Exhibit B correspond to the identification numbers referred to in the following paragraphs.

(a) Levee Drainage Structure (Station 4+25L). This gravity outlet structure, located 425 feet from the north end of the earth levee portion of the hurricane protection, consists of a 24 inch diameter corrugated metal pipe extending through the levee for a length of 160 feet, from a concrete inlet structure located on the protected (land) side of the levee to Control Manhole No. 1 located on the bay side of the levee at Levee Station 4+25L. The 24 inch diameter pipe is provided with a 24

inch diameter manually operated sluice gate located in Control Manhole No. 1. The gate lift control with enclosed gears, stem cover, locking device and indicator are located on top of the Control Manhole. Control Manhole No. 1 is enclosed by a 6 foot high chain link fence with access via a 3 foot wide swing gate with padlock. From Control Manhole No. 1, the drainage is conveyed in a southwesterly direction for a distance of about 95 feet via a 24 inch diameter corrugated metal pipe terminating at Manhole No. 2 which is located just south of the centerline of the re-located N. J. Route 35 service road (approximate Station N. J. 109+20) and about 100 feet west of the intersection of the levee centerline and the centerline of the service road. The 24 inch diameter pipe terminating in Manhole No. 2 is provided with a 24 inch automatic drainage (flap) gate. Also draining to Manhole No. 2 is an existing 18 inch diameter cast iron pipe from the northwest. Drainage from Manhole No. 2 is discharged by gravity via an existing 24 inch diameter pipe which extends southwest from Manhole No. 2 for a distance of about 150 feet, passing under N. J. Route 35, to an existing ditch which empties into Stump Creek. Drainage from the north to the concrete inlet structure located at Station 4 + 25L on the land side of the earth levee berm consists of the following:

(1) A paved drainage ditch extending north from the concrete inlet structure at Levee Station 4 + 25L for a distance of about 80 feet along the land side of the earth levee berm provides for drainage of the levee berm on the west and low lands on the east.

(2) The paved drainage ditch then branches off into a paved section and an unpaved section. The unpaved section continues north along the landside of the earth levee berm for an additional 140 feet to levee

station 2 + 25L. The paved section of drainage ditch sweeps around in a general northeasterly direction for a distance of about 230 feet to Cliffwood Way where it drains a 52 foot long concrete roadway trench in Cliffwood Way. The roadway trench is provided with gratings to accommodate roadway runoff.

(3) Unpaved drainage ditches are trapezoidal-shaped with a 2 foot bottom width and sides sloped 1 foot vertical to 2 feet horizontal, and are surfaced with 4 inches of topsoil and seeded. Paved portions of drainage ditches are trapezoidal-shaped with a 1 foot bottom width and sides sloped 1 foot vertical to 1.5 feet horizontal and are paved with 6 inches of concrete.

Drainage from the south to the concrete inlet structure located at Station 4 + 25L on the land side of the earth levee berm consists of the following:

(1) An unpaved drainage ditch extending generally south from the concrete inlet structure at Levee Station 4 + 25L for a distance of about 175 feet to a concrete headwall located north of and adjacent to the re-located N. J. Route 35 service road about 95 feet east of the intersection of the earth levee centerline with the service road.

(2) Draining to the unpaved ditch at the concrete headwall is an 18 inch corrugated metal pipe from Drop Inlet No. 2 (Station NJ 111 + 70) which is located adjacent to the north curb on the N. J. Route 35 service road about 145 feet east of the intersection of the levee centerline with the service road. Draining to Drop Inlet No. 2 is a 12 inch reinforced concrete pipe from Drop Inlet No. 1, (Station N.J. 111 + 70) which is located adjacent to the south curb of N. J. Route 35 service road about 25 feet south of Drop Inlet No. 2.

(b) 24 inch C.M. Pipe, Station 21+25. This drainage structure, located approximately 250 feet northwest of the junction of Shore Land Circle and Harbor Way, consists of a 24 inch corrugated metal pipe extending for a distance of about 390 feet from a drop manhole located on the land side of the beach protection, to Raritan Bay.

(c) 18 inch C.M. Pipe, Station 31+25. This drainage structure, located approximately 30 feet east of the junction of Shore Land Circle and Seaview Avenue, consists of an 18 inch corrugated metal pipe extending for a distance of about 350 feet from a drop manhole located on the land side of the bluff protection, to Raritan Bay.

(d) 30 inch C.M. Pipe and Manhole, Station 39+25. This drainage structure, located approximately 200 feet northwest of the junction of Bay View Drive and Wilson Avenue, consists of a 30 inch corrugated metal pipe extending for a distance of about 480 feet from a manhole located on the land side of the bluff protection, to Raritan Bay. Draining into the manhole is an existing 8 inch pipe from the southeast, an existing 18 inch pipe from the south and an existing 24 inch by 12 inch culvert from the southwest.

(e) 12 inch C.M. Pipe, Station 41+50. This drainage structure, located approximately 100 feet northeast of the junction of Bay View Drive and Wilson Avenue, consists of a 12 inch corrugated metal pipe extending for a distance of about 420 feet from a drop manhole located on the land side of the bluff protection, to Raritan Bay.

(f) 15 inch C.M. Pipe, Station 47+85. This drainage structure, located approximately 100 feet east of the junction of Bay View Drive and

Cleveland Avenue, consists of a 15 inch corrugated metal pipe extending for a distance of about 270 feet from a drop manhole located on the land side of the bluff protection, to Raritan Bay.

(g) 15 inch C.M. Pipe, Station 48+60. This drainage structure, located approximately 70 feet north of the junction of Bay View Drive and Garfield Avenue, consists of a 15 inch corrugated metal pipe extending about 270 feet from an existing 15 inch pipe located on the landside of the bluff protection, to Raritan Bay.

(h) 15 inch C.M. Pipe, Station 49+00. This drainage structure, located approximately 90 feet northeast of the junction of Bay View Drive and Garfield Avenue, consists of a 15 inch corrugated metal pipe extending about 280 feet from an existing 15 inch pipe located on the land side of the bluff protection, to Raritan Bay.

(i) 15 inch C.M. Pipe, Station 49+50. This drainage structure, located approximately 120 feet east of the junction of Bay View Drive and Garfield Avenue, consists of a 15 inch corrugated metal pipe extending for a distance of about 270 feet from a drop manhole located on the land side of the bluff protection, to Raritan Bay.

(j) 12 inch R.C. Pipe, Station 57+50. This drainage structure, located approximately 270 feet northeast of the junction of Bay View Drive and Jefferson Avenue, consists of a 12 inch reinforced concrete pipe extending about 180 feet from an existing 12 inch concrete pipe located on the bay side of the bluff protection, to Raritan Bay.

(k) 24 inch C.M. Pipe, Station 65+70. This drainage structure, located approximately 940 feet east of the junction of Bay View Drive and

Jefferson Avenue, consists of a 24 inch corrugated metal pipe extending about 400 feet from the existing 24 inch Margaret Creek Culvert located on the land side of the beach protection, to Raritan Bay.

(1) 36 inch R.C. Pipe, Station 83+20. This drainage structure, located adjacent to the east end of the Madison Township Sewage Disposal Plant, consists of a 36 inch reinforced concrete pipe extending about 270 feet from an existing 36 inch concrete storm drain located on the land side of the beach protection, to Raritan Bay.

23. Maintenance. Provisions for maintenance of drainage facilities are stated in paragraph (d) (1) of the Regulations, Exhibit A. The inspections, at intervals indicated in paragraph 11 of this Manual are to insure that the pipes or culverts are free of trash and debris; that drainage gates are unobstructed, in proper alignment, and operating freely; that pipes are in good condition; that no erosion which will expose and endanger the pipes and pipe supports is occurring; and that no fires are being built in pipes and structures. Necessary repairs should receive prompt attention. Prevention of vandalism is important. The Regulations require that automatic drainage (flap) gates and manually operated sluice gates on drainage structures shall be examined, oiled and trial operated at least once every 90 days. Frequently, well meaning but uninformed residents will prop a flap gate open to facilitate local runoff without considering the serious consequences in the event of extreme high tide. Likewise gates of relief culverts are sometimes secured in a closed position to prevent leakage during high tidal stages without consideration of potential damage resulting from precipitation within the protected area.

Though such obstructions are placed with no malicious intent to damage beach protection works, the results are no less serious, and necessary steps should be taken to prevent such action. Another cause of failure is the collection of drift, debris and ice at outlets, which may block automatic gates in open and closed positions. The removal of such deposits should be part of regular maintenance. A suggested form of check sheet for reporting conditions of drainage structures during inspections is presented in Exhibit G and a suggested form of check sheet for reporting conditions at drainage gates during inspections is contained in Exhibit E. Drainage ditches should be periodically inspected to assure that the ditches in general are in good condition and sufficiently clear of obstructions and debris to permit proper functioning. A suggested form of check sheet for reporting conditions of drainage ditches during inspections is presented in Exhibit K. Paragraph (h) (1) of the Regulations requires that ". facilities which function as part of or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate measures taken". Township officials should be advised of the undesirable effects of filling in or developing low-lying areas in the vicinity of relief culverts since ponding of local runoff from the landside of levees is relied upon to prevent inundation of more valuable adjoining areas.

24. Operation (a). Paragraph (d) (2) of the Regulations (Exhibit A) states that: "Whenever high water conditions impend, all gates will be inspected" The gated outlet in Manhole No. 2 may be submerged with only a moderate rise in stages in Raritan Bay, therefore it will be necessary to inspect the gate and perform any necessary service prior to

undertaking other duties pertinent to the emergency. Exhibit E is a sample check sheet for such an inspection. The ponding of water at the intake of the drainage structure does not necessarily indicate serious leakage since such ponding may be due to local runoff. Leakage of the gate can be established from close observation of the direction of flow at the landside end of the inlet. The sluice gate in Control Manhole No. 1 is for emergency use only and is to be closed only when the automatic drainage (flap) gate in Manhole No. 2 is known to be malfunctioning.

(b) Maintenance and operation of the sewers is the responsibility of the Township of Madison. Maintenance forces will report all modifications to the sewer facilities made or contemplated by the Township. Modifications which affect the Beach Erosion Control and Hurricane Protection works particularly those requiring work on project lands are not to be undertaken without prior approval of the District Engineer (Paragraph (a) (5) of the Regulations (Exhibit A).

VII - HURRICANES

25. General. The Environmental Science Services Administration (U. S. Weather Bureau) is responsible for issuing warnings of hurricanes which approach the U. S. Mainland. During the summer and fall, when most hurricanes occur, forecast offices at San Juan, Miami, New Orleans, Washington and Boston install special communications facilities and maintain a careful watch for the development of tropical storms and hurricanes. As soon as there are definite indications that a hurricane is forming, even though it is a thousand miles or more from the mainland, the storm is given a name and the Weather Bureau begins issuing "advisories". The advisories are issued frequently throughout the day and night and tell where the storm is, how intense it is, and its speed and direction of movement.

26. Description. Hurricanes are large revolving storms accompanied by violent destructive winds, heavy rains, and high waves and tides. Hurricanes originate in all tropical ocean areas except the South Atlantic and usually move from low to higher latitudes with increasing speed, size, and intensity. The winds whirl counterclockwise (in the Northern Hemisphere) in the storm with the highest speeds in a circular band beginning at the edge of the "eye" and extending out 20 to 30 miles or more. In this area velocities may reach 150 miles per hour with brief gusts to even higher speeds. At the center there is usually a small, cloudless core from 5 to 20 miles across. This core is called the "eye", since the sky is often clear or only partly cloudy and the winds are usually very light. The area of destructive winds along the path of a hurricane may be from 25 to 500 miles wide. As the storm develops and

moves forward, it may traverse a path several thousand miles long, as measured from its birthplace in the Caribbean or Tropical Atlantic until it moves inland over the continent, or blows out into the North Atlantic. While the winds of the hurricane are blowing at great speed around the center the entire storm may move forward very slowly and sometimes even remain stationary for a short time. This is especially true while the hurricane is in the tropics, where the forward speed is usually 15 miles per hour or less. As the hurricane moves farther from the tropics, the forward speed usually increases and in extreme cases may reach 50 miles an hour or more. The winds of a hurricane can do great damage. While they do not have the force of a tornado, they topple trees, blow over houses, tear down power lines, and even blow trains off their tracks. The greatest loss of life during hurricanes, however, is caused by drowning. As the storm moves forward, it often piles up huge waves which cut off or completely cover low-lying beaches and islands. The ocean level may rise 6 feet or more in a few minutes. Small boats are flung high on beaches. Giant waves pound and smash shore buildings, roads, and bridges, and may wash away long standing sand dunes. Most hurricanes are accompanied by torrential rains which cause additional damage by flooding and destroying crops, washing out roads and bridges, and flooding low-lying communities.

27. Hurricane Watch. When the Weather Bureau considers a hurricane an appreciable threat to coastal areas, a "hurricane watch" is announced for the vulnerable areas. The "hurricane watch" does not constitute a warning that hurricane conditions are imminent, rather it indicates

that the hurricane is close enough that every one in the area covered by the "watch" should listen for further advisories and be ready to take precautionary action in case warnings are issued. At this time personnel responsible for the efficient operation and maintenance of all structures and facilities appurtenant to the Beach Erosion and Hurricane Protection Project (See Section III this Manual) should be alerted and mobilized.

28. Hurricane Warning. As soon as the forecaster determines that a particular section of the coast will feel the full effects of a hurricane, he issues a "hurricane warning". Hurricane warnings specify coastal areas where winds of 75 mph or higher are expected to occur. When the warning is issued all precautions should be taken immediately against the full force of the storm. Hurricane warnings are seldom issued more than 24 hours in advance and sometime, in case of unusual or erratic hurricane movement, they may be issued only a few hours in advance of the onset of hurricane conditions. It is therefore of utmost importance that precautionary actions be instituted immediately when a "hurricane warning" is announced. Normal civil defense emergency and disaster plans should be put into effect by the local government when a hurricane threatens the beach, without regard to any protection that may be afforded by the berm. In connection with flood fighting, attention is invited to the New York District "Operating Procedures for Emergency Flood Control Activities" and "Natural Disaster Assistance", Supplement A and Supplement B, respectively, to Engineering Manual 500-1-1, "Natural Disaster Activities". These manuals outline the functions to be performed by the Corps of Engineers during floods. Liaison between the Corps of Engineers and other organizations such as the Weather Bureau

Red Cross, military organizations and local agencies concerned with activities during floods, are also described. Issuance of "hurricane warnings" does not mean that the center of the hurricane is always expected to pass inland over the area warned. Rather, the warnings indicate that winds of hurricane force are expected within the area of hurricane warning. Usually the winds gradually increase in velocity as the center approaches and may reach hurricane force as much as 6 hours or more before the center crosses the coast. Since dangerous winds may extend outward a considerable distance from the center of the storm, the area of danger is usually several times greater than that covered by the center itself. In some cases the center may "skirt" the coast and result in hurricane winds with the center never crossing the coast.

29. Storm Warning. These are warnings for coastal areas indicating that winds of more than 32 mph, but of less than hurricane force, will occur. They are issued not only in connection with hurricanes but with other types of coastal storms. There are several circumstances under which they may be issued in connection with hurricanes. If a hurricane approaches close enough to cause strong winds but not close enough to cause hurricane conditions, "storm warnings" may be issued. Should the hurricane continue moving toward the coast, the "storm warnings" may be changed to "hurricane warnings", and "storm warnings" may be issued for other areas on either side of the expected hurricane path.

VIII - HIGH WATER MAINTENANCE AND OPERATION

30. Scope. This section of the manual is supplementary in nature and intended as an outline of standard practices that have been developed during years of experience with the various problems that arise during storm periods. The remarks are primarily concerned with the levee portion of the hurricane protection system. Reference is made to the applicable sections of this manual for details concerning high water operation of other features of the protection.

31. General. A rapid rise of the bay leaves little time to make emergency repairs. Effective flood fighting under these circumstances can be carried on only if there is a well organized and trained crew, together with an ample supply of suitable materials immediately available. Confidence of the protected persons and firms is a valuable asset that should not be carelessly lost through inefficient operation of the protection system in time of emergency. It is possible that dangerous conditions may arise which are not covered by these instructions. It is not the intent to restrict the Superintendent, or others concerned, to a rigid set of rules. Difficult conditions can usually be met by the methods suggested here, together with independent initiative and action along with sound engineering principles. In cases where the Superintendent is in doubt as to the procedure to be taken, he will be expected to consult the District Engineer through the Chief, Operations Division, Department of the Army, New York District, Corps of Engineers, 26 Federal Plaza, New York, N. Y. 10007, Telephone Area Code 212, 264-9020.

32. Earthwork. Well constructed levees of proper cross-section should, if properly maintained and not overtopped, hold throughout any major

storm. A break may result in serious damage if not actual loss of life.. Unforeseen foundation conditions may result in sand boils or levee settlement. Wave wash inherent to a wide stretch of open water is expected to be a problem in this area, particularly if permitted to continue over an extended period. For methods of combating wave wash refer to Plates 4, 5 and 6 of this manual. High waves and tides may cause erosion of embankments tending to promote caving banks or slides. Such threatened failure can be successfully met with prompt action and proper methods of treatment as suggested in the following paragraphs.

33. Preliminary Work. Upon receipt of information that high water is imminent, the Superintendent should immediately mobilize the skeleton force of key personnel which has previously been formed as outlined in paragraph 10 of this manual. Following this, reserve labor forces should be alerted for call on emergency work. As his initial activity, each sector foreman should make an immediate inspection of his assigned section to ascertain the following:

- (a) Condition of all drainage gates. (Exhibit B and E)
- (b) Condition of levee including areas of recent repair.
(Exhibit H)
- (c) Location of any encroachment on right-of-way interfering with access and efficient operation.
- (d) Transportation facilities, including trucks available, and possible detours.
- (e) Material supply: Items necessary for emergency repairs; quantity, locations, and conditions. (Exhibit J)

(f) Communications: Convenient telephone available at any hour; also police and radio systems.

(g) Location of relief organizations.

34. Operation of Drainage Structures. After the initial inspection, or in connection therewith, the responsible sector foreman should see that the automatic drainage gate located in Manhole No. 2 is free of obstructions or defects so as to seat properly on the outlet of the gravity pipe. The importance of this step cannot be overemphasized. Once the gate is submerged by rising stages proper servicing becomes difficult if not impossible. Should the flap gate fail to close, the adjacent sluice gate located in Control Manhole No. 1 should be operated to close the outlet and afford positive protection. The sluice gate should be trial operated but kept open and only closed when the automatic flap gate is not operating properly and is allowing backwater into the protected area. Sector foremen should be furnished copies of Plate 1 and Exhibits B, E, and F, to facilitate the inspection.

35. Precautionary Measures. After determining that the gates are either securely closed or known to be operating in a satisfactory manner, or concurrently with making such determination, attention should be given to the following additional items wherever applicable and the necessary work performed without delay:

(a) Fill with compacted material any holes or washes found in the levee.

(b) Repair gaps where levee crown is worn down or where levee is below grade. The use of sandbags is preferable to loose material during an emergency.

(c) Obtain necessary tools and materials (sacks, sandbags, brush, lumber, lights, etc.) and distribute and store the same at points where active maintenance is anticipated.

(d) Investigate all drainage ditches and storm drainage inlets on the land side of the improvement works and open these drains when obstructions exist.

36. Patrol. After preliminary work is completed, continuous patrol should be established, if not previously done, and maintained during the storm period to locate:

(a) Possible sand boils or unusual wetness of the landward slope of levees.

(b) Indication of embankment slides or sloughs.

(c) Possible wave wash or scouring.

(d) Low reaches of levee that may be overtopped.

(e) Leakage through or at drainage gates and along culvert and sewer pipes.

(f) Any condition or encroachment that might endanger the levee or the operation of drainage structures.

37. Drainage of Slopes. Should seepage through the levee embankment occur, its effect can be minimized by cutting seep drains at locations where the seepage appears. The drains should be V-shaped, as shallow as possible, and never more than six inches deep. Care must be taken not to cut the sod unnecessarily. Drains should be cut straight down, and not lengthwise, along the levee slope. Seepage should be diverted from the

land side toe of the levee by ditching to the main drainage ditch or nearest storm drainage facility. Locations, where it has been necessary to cut these drains, should be kept under observation, for this seepage may be indicative of an incipient slide or slough. If the seepage increases and is carrying particles of earth with it, and if longitudinal cracks form in the slopes or cross with it, a settlement or slide may be imminent. When such conditions appear, the treatment indicated in paragraph 38 of this manual should be applied.

38. Sloughs. Should any sloughs develop in the levees, all soft areas should be thoroughly drained as described in paragraph 37 above, after which a single layer of willow brush, or any small trees or limbs, should be laid on the slope with the butts up and tops down, and weighted with sacks. In lieu of brush, a layer of picket snow fence, topped with a mat of sandbags, may be used. Care should be taken not to obstruct the small drainage ditches. This type of treatment is indicated in Plate 3 of this manual. If the slope begins to slough down, a buttress of sacks should be built on the toe extending part way up the slope. No sacks or weight other than that necessary to hold the brush in place should be placed higher than two-thirds of the way from the toe of the slope to the point where the sloughing has taken place.

39. Scours. The approved method of checking scour is to construct deflection dikes, using brush, treetops or lumber, driving stakes and wiring together and filling in between with brush and filled sacks of stone. Plate 7 shows the method of constructing deflection dikes. Scour is not expected to be a major problem along the bay side of the levee.

40. Topping. Consideration should be given to the possibilities of water overtopping the levee, at any point where the levee might have a tendency to settle for any reason. The emergency topping, under such circumstance, may be done (a) by sacked earth (b) with lumber and sacked earth, (c) with mud boxes, or (d) by cutting back of crown and raising front crown. These methods are described below:

(a) Sack Topping. If lumber is not available, a sack topping (Plate 8) may be used to raise the crown of the levee as much as three feet. The sacks should be laid lengthwise along the levee for the first layer, crosswise for the second layer, and so on. Sacks should be lapped at least $1/3$ of their length and well mauled or tamped in place. Sacks should never be filled more than two-thirds full. They should be tied at the throat in such a manner that the material is loosely contained in the sack in order to facilitate mauling or tamping. When properly sacked and tamped, one sack will give about three to four inches of topping. If gravel is available, it should be used for the front facing so as to avoid washing out.

(b) Lumber and Sacked Earth Topping. This is the most commonly used method of raising low reaches in emergencies. Two inch by four inch or two inch by six inch stakes should be driven on the bay side and the land side of the crown six feet apart, and one inch boards nailed to the land side of the bay side stakes. This wall, backed with a single tier of sacks will hold out at least one foot of water. If a second foot is necessary, the layers of sack will have to be increased in number and reinforced. See Plate 9 of this manual for details of this method of protection. In some instances, it may be practicable

to back up the planking with tamped earth obtained in lieu of the sacks shown on the drawing.

(c) Mud Box. A standard double bulkhead mud box is shown on Plate 10 of this manual. The size of the box is controlled by the conditions under which the box will function, available materials, method of placing the dirt, and time element.

(d) Cut Crown Topping. This method of obtaining additional height should never be used except as a final alternative in the event that filled sacks and lumber are unobtainable. When undertaken, it shall be done only by authority of the District Engineer under very strict supervision. The source of material is the landside crown of the levee where the depth of cut should be greater than one foot and not riverward of the centerline of the levee.

41. Sand Boils. Even with proper levee construction, seepage through a pervious stratum under the levee can occur and break through the ground surface on the landward side of the levee. These "blowouts" or sand boils are danger spots when discharging solids. An effective way to localize the danger from a sand boil is to build a watertight sandbag ring around it, making the ring sufficiently large to avoid the defective area immediately surrounding the boil. The ring should be of such height that a counter-acting head is produced which reduces the pressure and velocity of flow below the critical point so that erosion of material ceases. No attempt should be made to completely stop the flow of water as other boils might then occur outside the sandbag ring. If several sand boils occur in an immediate vicinity, a sandbag sub-levee should be built around the entire nest of boils, rising to such a height that none of the boils will discharge with enough force to displace sand or silt. It is advisable to carry off the water from the ringed boil through a small spillway by means of a V-shaped trough constructed of two boards or a piece of sheet metal.

Discharge should be diverted to the nearest drainage ditch or other facility where practicable. If the water from the boil is clear, there is no danger of the levee failing by undermining and such boils do not need to be ringed. See Plate 2 of this manual which shows suggested treatment of sand boils.

IX - REAL ESTATE

42. Federal Law. Under provisions of the River and Harbor Act of 1962 and in accordance with House Document No. 464, 87th Congress, 2nd Session local interests were required to provide without cost to the United States all lands, easements, and right of ways, including borrow-areas, necessary for the construction of the project.

43. Interests in Real Estate. In accordance with the Authorizing Document the Township of Madison acquired title to all properties and interests in such properties required for the Beach Erosion Control and Hurricane Protection Project.

44. Real Estate Records. Maps of lands which have been acquired similar to those shown in Appendicies 1-4 of this manual are on file at the Department of the Army, New York District, Corps of Engineers, 26 Federal Plaza, New York, New York. No encroachment or trespass which will affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way. No construction shall be permitted within the limits of the project right-of-way nor shall any change be made in any feature of the works without prior determination by the District Engineer, Department of the Army, Corps of Engineers, New York, N. Y. that such improvement, construction or alteration will not adversely affect the functioning of the protective facilities.

45. Ownership of Facilities. All structures erected and equipment installed by the Federal Government, except those constructed for local interests at their request, remain Federal property, although their maintenance, operation and replacement is the responsibility of the State of New Jersey and local interests.

OPERATION AND MAINTENANCE MANUAL
RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
MADISON TOWNSHIP

BEACH EROSION AND HURRICANE PROJECT

EXHIBITS

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1926, as amended and supplemented (49 Stat. 1871; 50 Stat. 877; and 55 Stat. 638; 23 U. S. C. 701c; 701d-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 Local flood protection works; maintenance and operation of structures and facilities.—(a) General. (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) Levees.—(1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) Flood walls.—(1) Maintenance. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) Operation. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) Drainage structures.—(1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(1) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(II) Inlet and outlet channels are open;

(III) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) Operation. Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) Closure structures—(1) Maintenance. Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(II) Metal parts are adequately covered with paint;

(III) All movable parts are in satisfactory working order.

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) Operation. Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure all Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) Pumping plants—(1) Maintenance. Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) Operation. Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) Channels and floodways—(1) Maintenance. Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(II) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(III) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition.

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) Operation. Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all anags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) Miscellaneous facilities—(1) Maintenance. Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) Operation. Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWF)

[SEAL]

J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 44-12355; Filed, August 16, 1944;
9:44 a.m.]

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

LIST OF DRAINAGE STRUCTURES

Identification on Plate 1	Station (Approximate)	Outlet Size	Gate Size	Type	Remarks
Drop Inlet No. 1	NJ 111 + 70 (Route 35 Stationing)	12 inch	None		Drains to Drop Inlet No. 2
Drop Inlet No. 2	NJ 111 + 70 (Route 35 Stationing)	18 inch	None		Drains to levee drainage structure via 18 inch C.M. pipe and unpaved ditch.
Roadway Trench in Cliffwood Way	-	1'-6" width	None		Drains to levee drainage structure via paved ditch.
Levee Drainage Structure	4 + 25L (Levee Stationing)	24 inch	--		Concrete Inlet on Landside of Levee berm, drains to Control Manhole No. 1
Control Manhole No. 1	4 + 25L (Levee Stationing)	24 inch	24"	Sluice	Manually operated sluice gate; Drains to Manhole No. 2
Manhole No. 2	N.J. 109 + 20 (Route 35 Stationing)	24 inch	24"	A.D.	Drains to Stump Creek via existing 24 inch pipe and ditch.
24 inch C.M. Pipe and Drop Manhole	21 + 25	24 inch	None		Drains to Raritan Bay; Drop Manhole constructed by other than Federal Government.
18 inch C.M. Pipe and Drop Manhole	31 + 25	18 inch	None		Drains to Raritan Bay; Drop Manhole constructed by other than Federal Government.
30 inch C.M. Pipe and Manhole	39 + 25	30 inch	None		Drains to Raritan Bay.
12 inch C.M. Pipe and Drop Manhole	41 + 50	12 inch	None		Drains to Raritan Bay; Drop Manhole constructed by other than Federal Government.
15 inch C.M. Pipe and Drop Manhole	47 + 85	15 inch	None		Drains to Raritan Bay; Drop Manhole constructed by other than Federal Government.
15 inch C.M. Pipe	48 + 60	15 inch	None		Drains to Raritan Bay
15 inch C.M. Pipe	49 + 00	15 inch	None		Drains to Raritan Bay
15 inch C.M. Pipe and Drop Manhole	49 + 50	15 inch	None		Drains to Raritan Bay Drop Manhole constructed by other than Federal Government.
12 inch R.C. Pipe	57 + 50	12 inch	None		Drains to Raritan Bay.
24 inch C.M. Pipe	65 + 70	24 inch	None		Drains to Raritan Bay.
36 inch R.C. Pipe	83 + 20	36 inch	None		Drains to Raritan Bay.

Note: 1) Stationing, except as noted, is along survey baseline which generally follows shore line (See Plate 1)
2) C.M. - Corrugated Metal
R.C. - Reinforced Concrete
A.D. - Automatic Drainage (Flap) Gate

EXHIBIT B

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

LIST OF BENCH MARKS

Identification	Description	Elevation in Ft. M.S.L.
B.M. "X 36 1952"	USC & GS Disk set vertically in the North East face of the South East abutment of N.J. State Highway 35 Bridge over Cheese- quake Creek at Morgan, N.J. Bench mark is 30 feet southeast of center line of a black top street that is under highway bridge and 2 feet above ground.	11.683

EXHIBIT C

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

LIST OF TIDE GAGES

1. Raritan River at Perth Amboy, on upstream cribbing for pier supporting swinging section of Victory Bridge on State Route 35 in Perth Amboy, Middlesex County, New Jersey, 0.5 mile downstream from Garden State Parkway Bridge, and 1.5 miles upstream from mouth of Raritan River. Latitude $40^{\circ} 30' 31''$, Longitude $74^{\circ} 17' 30''$. Datum of gage 10.00 feet below mean sea level, datum of 1929. (Operated by the U.S. Geological Survey, 420 Federal Building, Trenton, New Jersey, Telephone Area Code 609, 599-3511).

2. The Narrows, at Fort Wadsworth, Staten Island, N.Y., eastern tip of Staten Island, upstream of the Verrazano - Narrows Bridge. Latitude $40^{\circ} 36'$, Longitude $74^{\circ} 03'$. Datum of Gage 12.33 feet below mean sea level, datum of 1929. Tidal data telemetered to the Survey Branch, Operations Division, Department of the Army, New York District, Corps of Engineers, N.Y., Telephone Area Code 212, 264-0180.

RARITAN BAY AND SANDY HOOK BAY
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

CHECK SHEET FOR INSPECTION OF
AUTOMATIC DRAINAGE GATES AND SLUICE GATES

Identification				Conditions
on		Gate		and
Plate 1	Location	Type	Size	Recommendations
<u>Levee Drainage</u>				
<u>Structure</u>	Center of relocated N.J.	A.D.	24"	
M.H. No. 2	Rt. 35 Service Road at approx. Sta. N. J. 109 + 20 about 100 feet west of intersection of Levee center line and service road			
C.M No. 1	Bay side of Levee at Levee Station 4+25L	Sluice	24"	

- Note:
- 1) Levee stationing is along center line of levee (see plate 1)
 - 2) N.J. Stationing is along center line of N. J. Rt. 35 (see plate 1)
 - 3) M.H. - Manhole
C.M. - Control Manhole
A.D. - Automatic Drainage (Flap)Gate

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

RECORD OF OPERATIONS
FOR
SLUICE GATES

Report by _____ Date _____ 19 _____

Date	Location and Identification	Sluice Gate		Remarks
		Time Closed	Time Opened	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	
		M	M	

EXHIBIT F

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

CHECK SHEET FOR INSPECTION OF DRAINAGE FACILITIES

ITEM	CONDITION	RECOMMENDATIONS
<u>Manhole</u>		
<u>Control Manhole</u>		
<u>Culvert</u>		
<u>Drain Outlet</u>		
<u>Drop Inlet</u>		
<u>Exposed Drain Pipe</u>		
<u>Pipe Restrainer Bents</u>		

CHECK SHEET FOR INSPECTION OF LEVEES

- Inspected by _____ Date _____ 19____

EXHIBIT H

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

CHECK SHEET FOR INSPECTION OF BEACH AND BERM

- () Routine Inspection
() Prior to (Hurricane) (Winter) Season
() Following Hurricane or Severe Storm

Item	Location	Condition	Recommendation
1. Unusual settlement			
2. Sloughing			
3. Material Loss of grade of beach and berm cross-section			
4. Escarping (especially during high water and winter season)			
5. Topping of berm during high water			
6. Destroyed or Dying Vegetative cover			
7. Excessive growth of undesirable grass and weeds			
8. Encroachment on beach and berm right-of-way (unauthorized construction, Vehicular traffic, etc.)			
9. Accumulation of Drift, Trash, debris, etc.			
10. Sand Fences			
11. General condition of beach and berm:			

() Good () Fair () Poor

Inspector _____ Date _____

EXHIBIT I

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

CHECK SHEET FOR INSPECTION OF SANDBAGS

() Routine

Inspection of Sandbags

() Emergency

Total number of sandbags on hand for this project _____.

Inspected by _____ Date _____ 19 ____.

Principal source of bags:

Building or establishment _____

Street Address _____

City _____

No. of bags on hand _____

Condition _____

Alternate source of bags:

Building or establishment _____

Street Address _____

City _____

No. of bags on hand _____

Condition _____

Principal locations where material is available for filling bags:

Location of Twine or wire:

REMARKS:

INSPECTOR _____

EXHIBIT J

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

CHECK SHEET FOR INSPECTION OF DRAINAGE DITCHES

Drainage Ditch _____

From _____ to _____

Inspected by _____ Date _____

Item	Station or Location	Condition	Recommendations
1. Weeds & wild growth in ditch			
2. Trash, ashes, debris, etc. dumped in ditch			
3. Structures or other unauthorized encroach- ment on the ditch.			
4. Erosion of slopes			
5. Riprap			

REMARKS:

INSPECTOR

EXHIBIT K

RARITAN BAY AND SANDY HOOK BAY, N. J.
MADISON TOWNSHIP
BEACH EROSION AND HURRICANE PROJECT

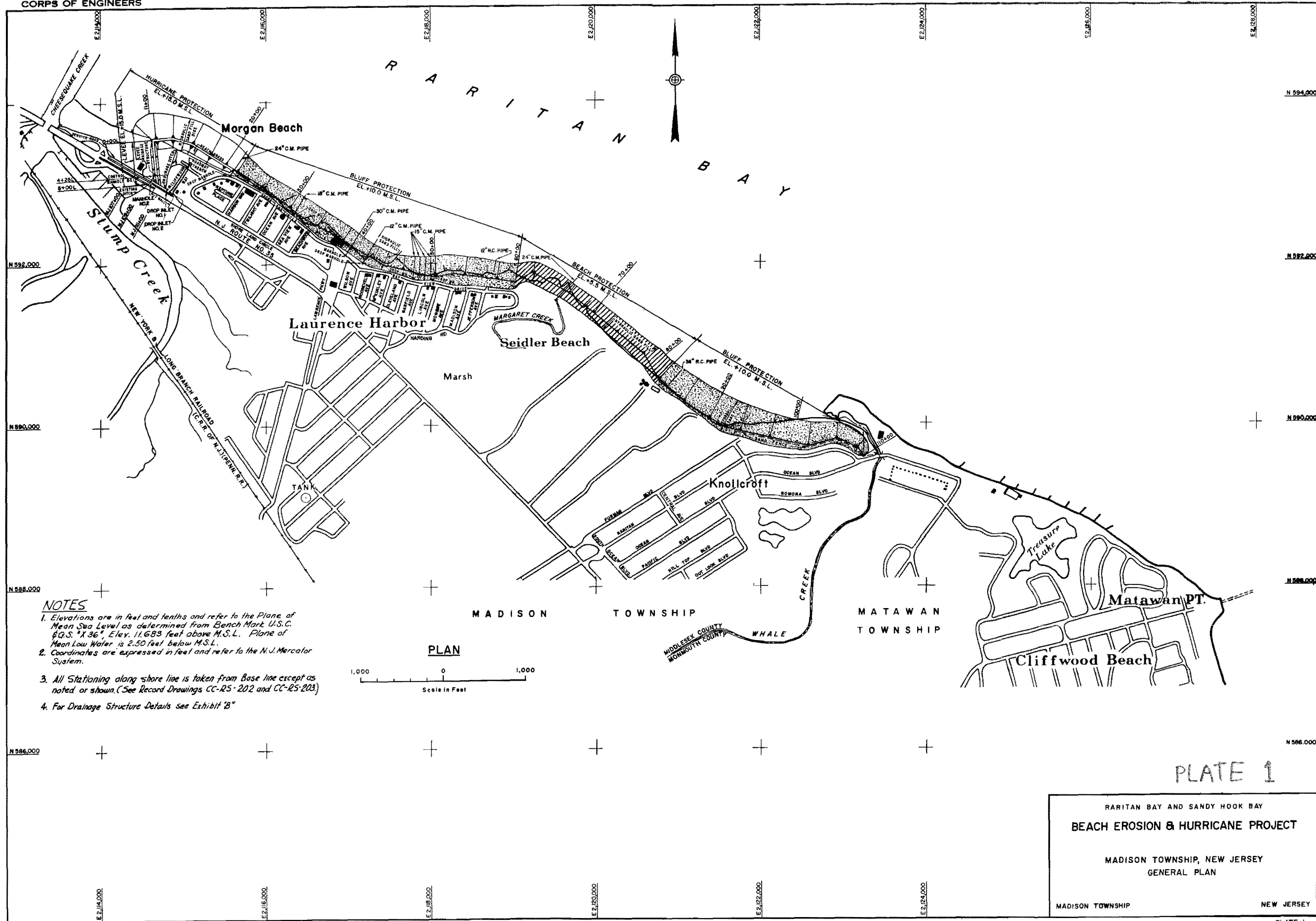
PERSONNEL DIRECTORY

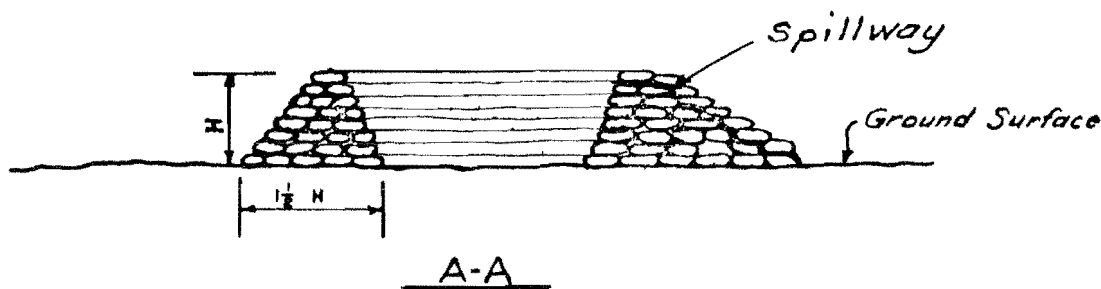
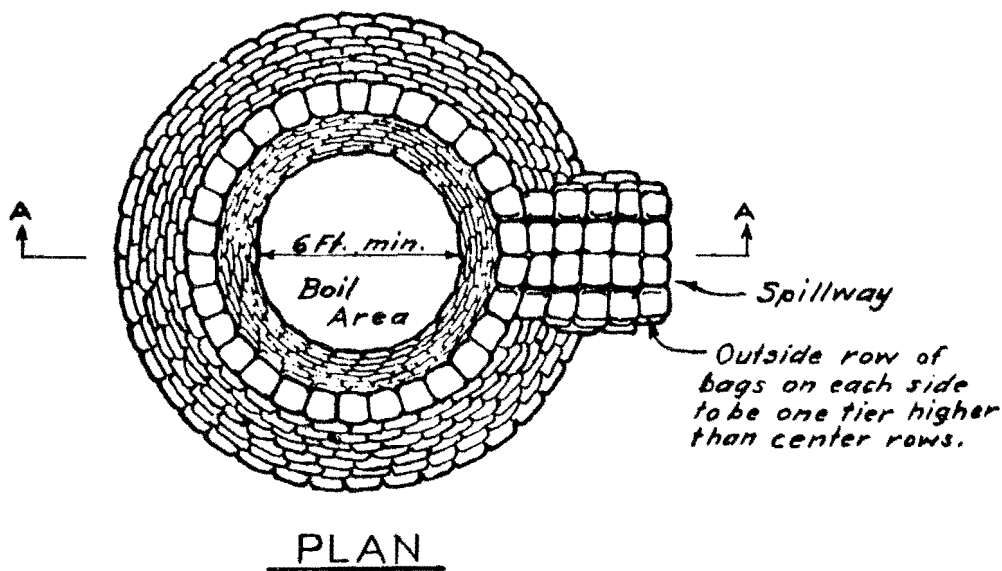
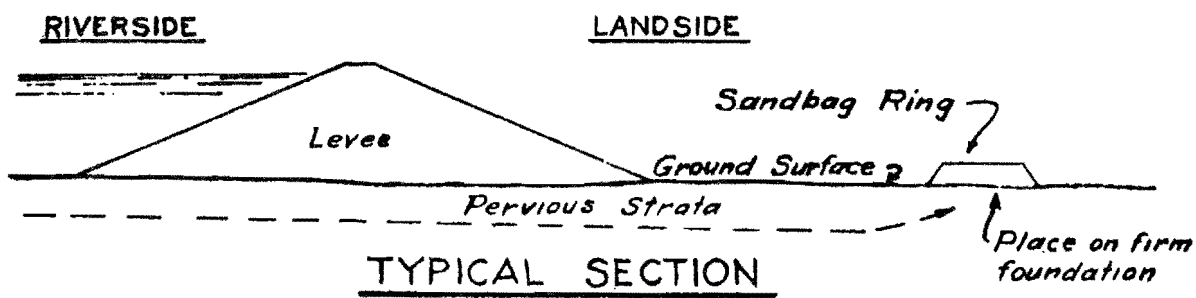
TITLE	ADDRESS	TELEPHONE	FUNCTION
Commissioner, Department of Conservation and Economic Development, State of New Jersey	Labor and Industry Building, John Fitch Way Plaza, P.O. Box 1390, Trenton, N.J. 08625	A/C 609, 292-2885	Superintendent, responsible for operation and maintenance of entire Beach Erosion and Hurricane Project. (See para. 10).
J.K. Rankin, Chief Engineer, Navigation Bureau, Department of Conservation and Economic Development, State of New Jersey	Labor and Industry Building, John Fitch Way Plaza, P.O. Box 1390, Trenton, N.J. 08625	A/C 609, 292-2652	Superintendent's Alternate (See para. 10)
Mayor, Township of Madison	Madison Township, N. J.	A/C 201, 721-5609	Supervision of Local personnel including the Township Engineer, Police Department and Public Works Department (see para 10)
J. Gelberman Chief, Operations Division, Department of the Army, New York District, Corps of Engineers	26 Federal Plaza, New York, N. Y. 10007	A/C 212, 264-9020	District Engineer's Representative (see para. 10, 13, and 31)
Meteorologist-in-Charge Environmental Science Services Administration (U.S. Weather Bureau)	Weather Bureau Office General Delivery Trenton, N. J. 08608	A/C 609, 396-8891	Weather, Tidal Conditions and forecasts for project area (see para. 10)
Chief of Marine Police, Monmouth Beach State Marina	Office of Marine Police, Monmouth Beach State Marina Monmouth Beach, N. J.	A/C 201, 229-6000	Weather Bureau Teletype Receiver (See para. 10)
Chief, Survey Branch, Operations Division, Department of the Army, New York District, Corps of Engineers	26 Federal Plaza, New York, N. Y. 10007	A/C 212, 264-0180	Telemetered tidal data for gage at Fort Wadsworth, Staten Island, N. Y. (See Exhibit D)

OPERATION AND MAINTENANCE MANUAL
RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
MADISON TOWNSHIP

BEACH EROSION AND HURRICANE PROJECT

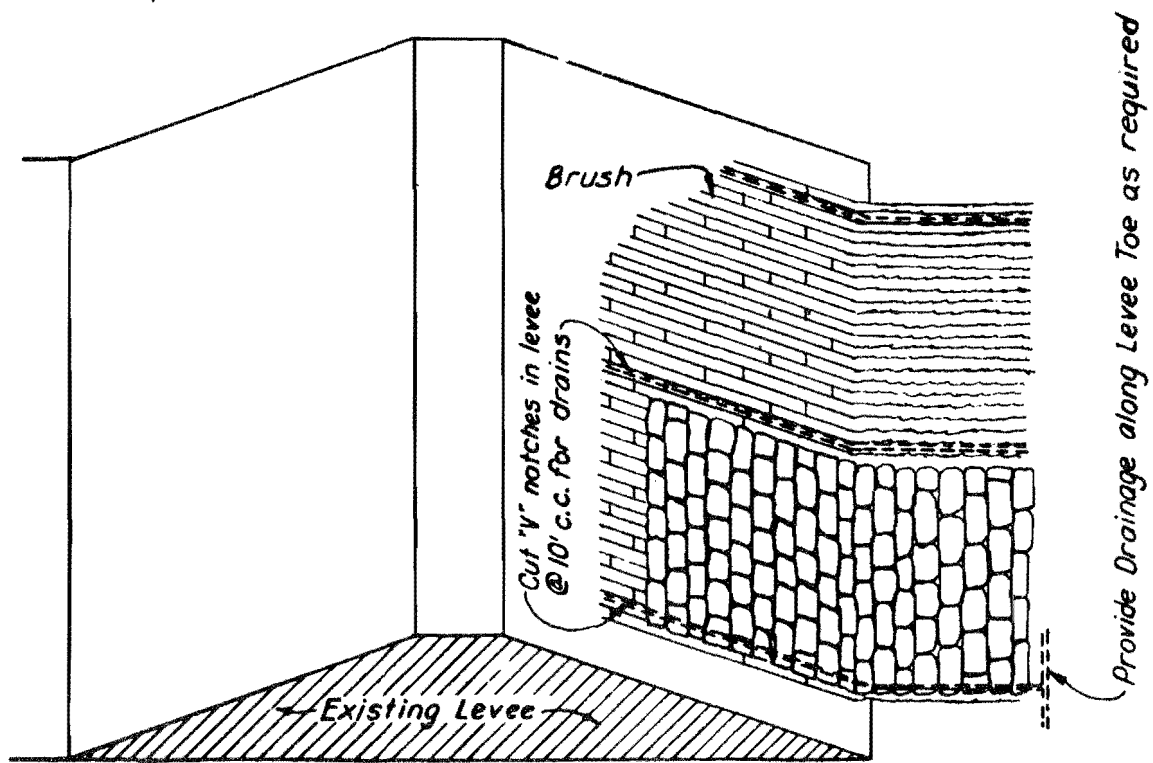
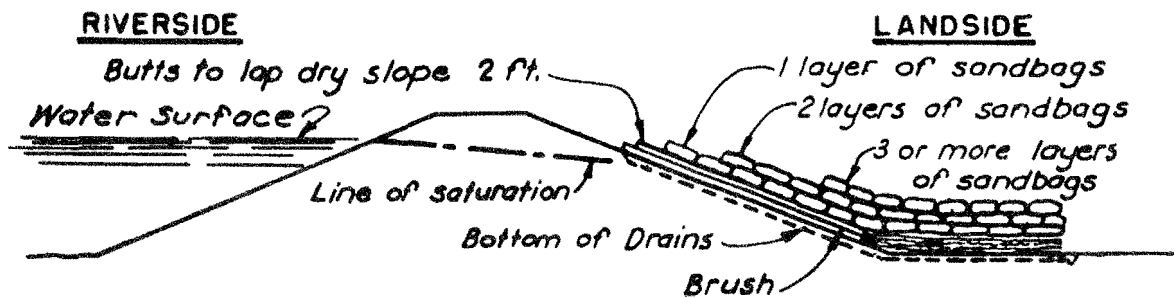
PLATES



**Note:**

Do not sack boil which does not discharge solids.
 Height of bag ring to be only sufficient to stop discharge of solids.
 Do not attempt to completely stop water flow through boil.
 Preferably use closely woven bags filled with clay or loam.
 If available, a metal ring such as a culvert pipe or bottomless tank, 6 to 8 ft. in diameter may be used instead of a sandbag ring.

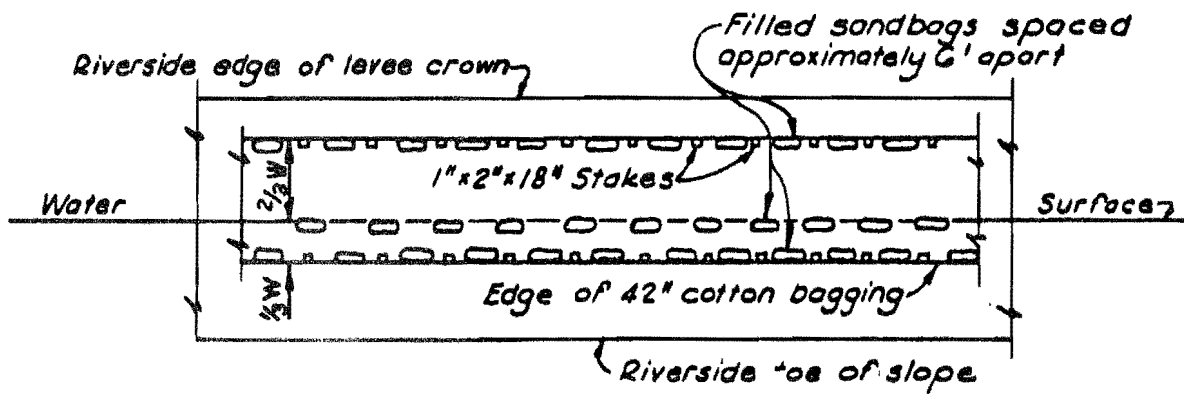
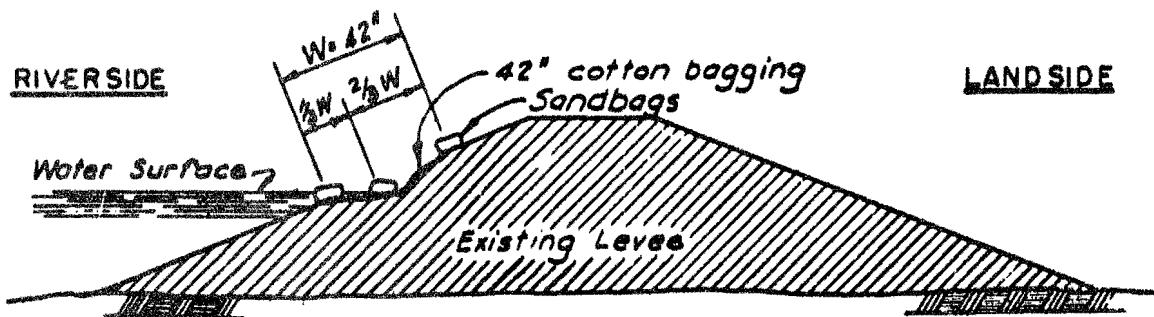
SANDBAG RING
 FOR SAND BOILS
 CORPS OF ENGINEERS, U. S. ARMY
 NEW YORK DISTRICT
 NEW YORK, N. Y.

PLANSECTION

Note:
Picket snow fence can be substituted
for brush.

TYPICAL TREATMENT OF EMBANKMENT SLOUGHS

CORPS OF ENGINEERS, U. S. ARMY
NEW YORK DISTRICT
NEW YORK, N. Y.

PLANSECTIONBILL OF MATERIAL TO CONSTRUCT 100 FT.

One roll regular (jute) cotton bagging 42" x 100'

50 - Filled sandbags

35 - Stakes 1" x 2" x 18"

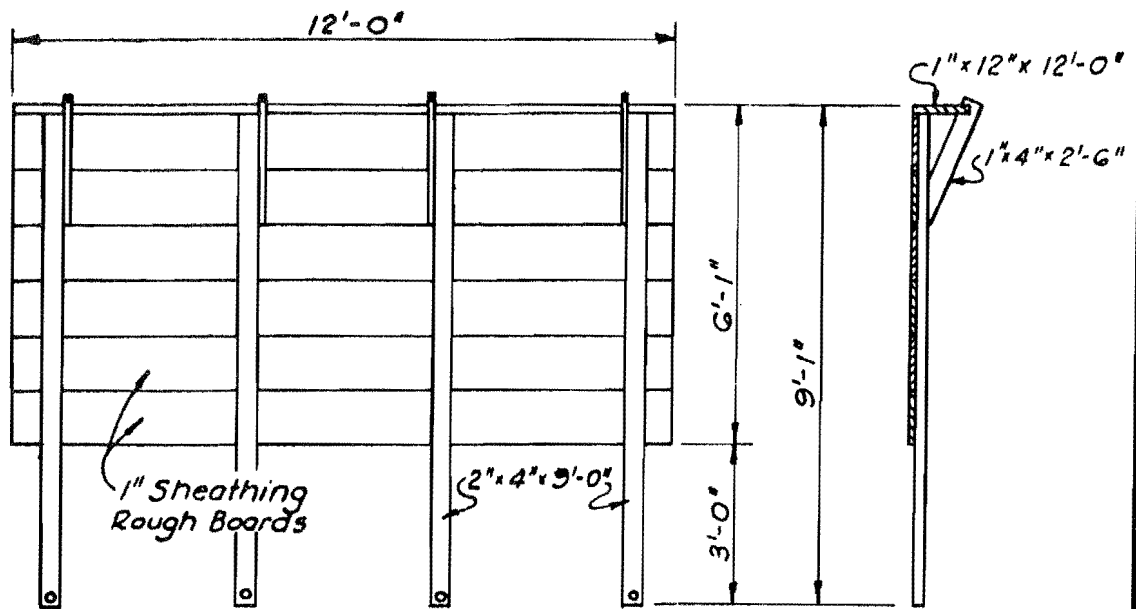
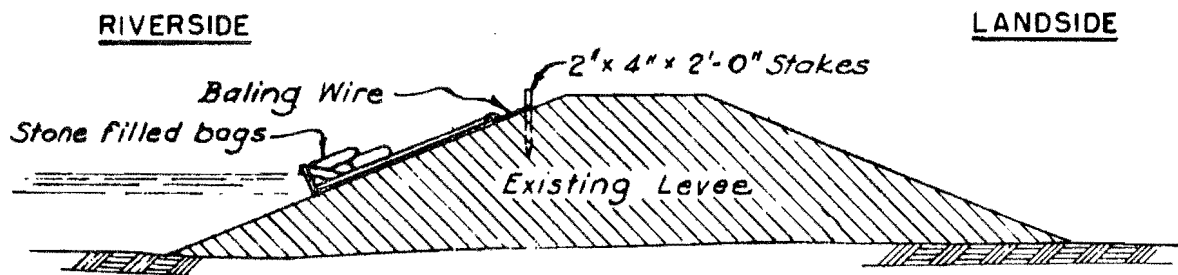
Note: Lay 42" wide cotton bagging longitudinally along riverside slope of levee with approximately $2\frac{1}{3}$ width of bagging laying above water surface. Weight edges and top of bagging along water surface with filled sandbags spaced approximately six feet apart. Drive stakes alternately between filled sandbags located along each edge of bagging. If regular 42" width cotton bagging is not sufficient in width to provide desired protection, two or more widths of bagging may be laced together and layed as desired.

**WAVE WASH PROTECTION
COTTON BAGGING**

CORPS OF ENGINEERS, U. S. ARMY
NEW YORK DISTRICT
NEW YORK, N. Y.

Diagram illustrating the construction of a bulkhead using sandbags. The diagram shows a cross-section of a bulkhead structure. A horizontal board is positioned across the top of the bulkhead. Two filled sandbags are placed across the top board of each bulkhead to help hold it in place. The sandbags are labeled with dimensions: 1" x 2" x 1'-6" and 1" x 4" x 8'-0". A single row of sandbags is shown behind the bulkhead. The area behind the bulkhead is labeled "Existing Lavee".

PLATE 5

PLANSECTIONTYPICAL SECTIONBILL OF MATERIAL TO CONSTRUCT 100 FT.Lumber

56 pieces - 1" x 12" x 12'-0"

32 pieces - 2" x 4" x 9'-0"

32 pieces - 1" x 4" x 2'-6"

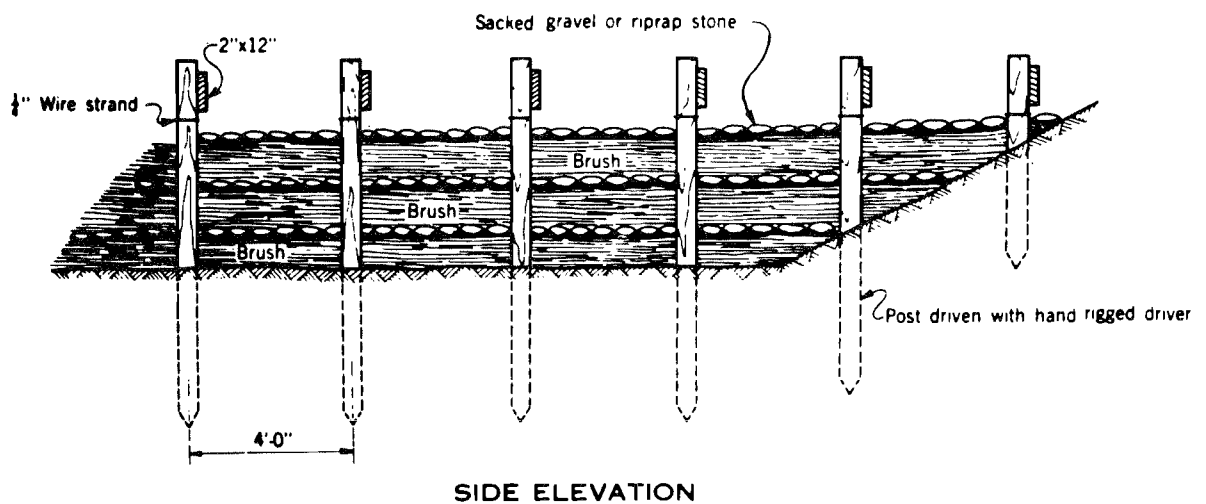
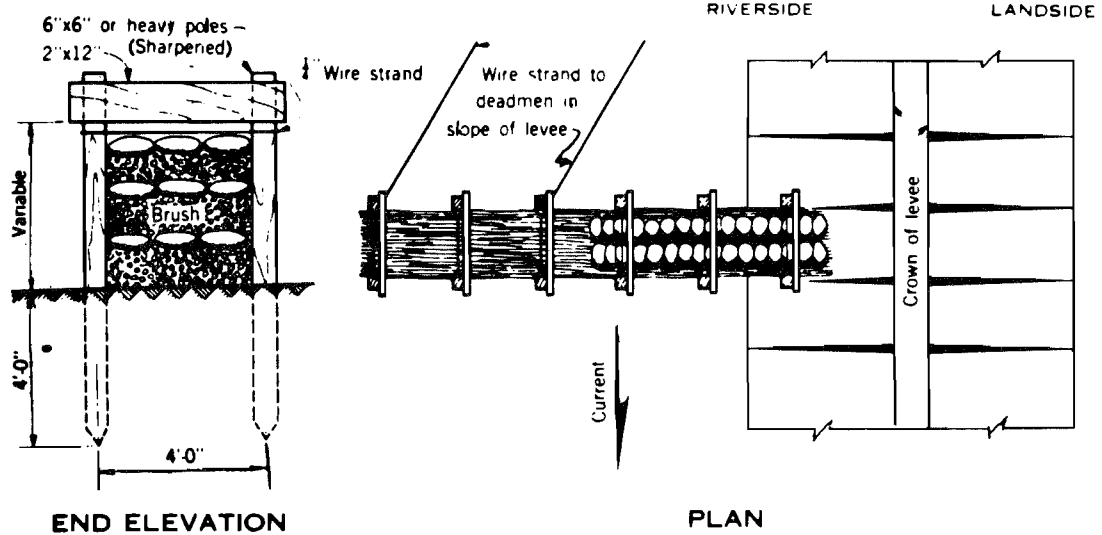
32 pieces - 2" x 4" x 2'-0"

6 lbs. - 8d Nails

5 lbs. - 10d Nails

72 Stone filled bags

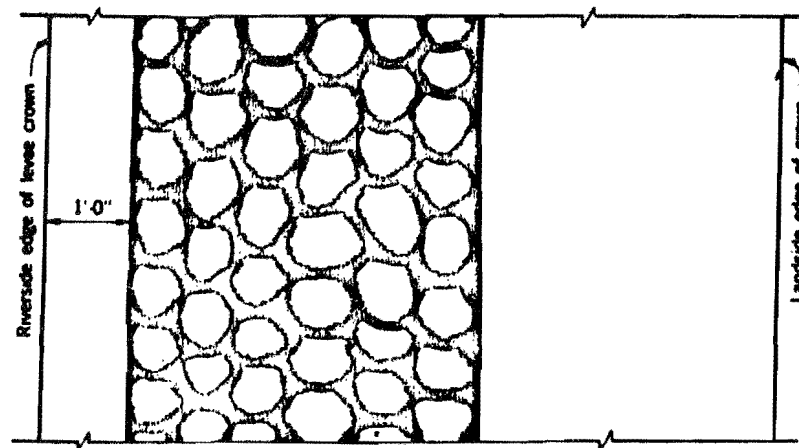
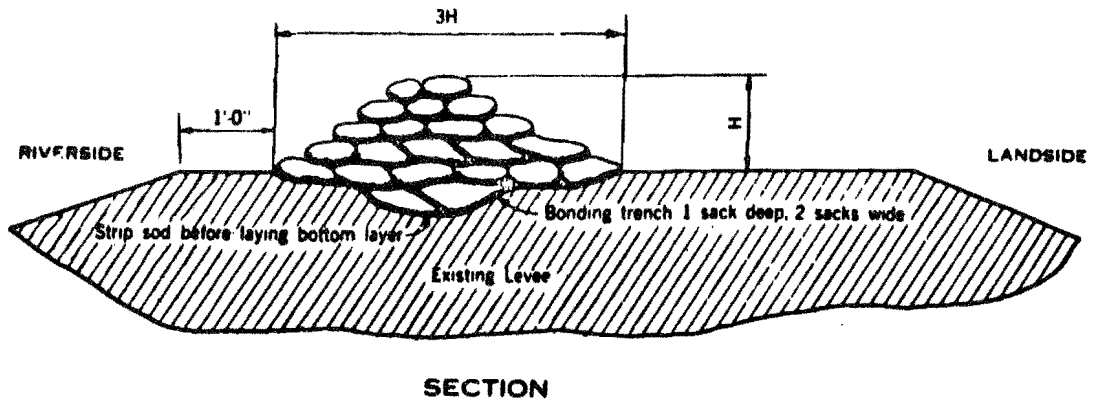
WAVE WASH PROTECTION
MOVABLE TIMBER BULKHEADCORPS OF ENGINEERS, U. S. ARMY
NEW YORK DISTRICT
NEW YORK, N. Y.



HIGH WATER MAINTENANCE

DEFLECTION DIKE

CORPS OF ENGINEERS, U. S. ARMY
 NEW YORK DISTRICT
 NEW YORK, N. Y.

**Note:**

Alternate direction of sacks with bottom layer lengthwise of levee, next layer crosswise, etc.

Lap unfilled portion under next sack.

Tying or sewing sacks not necessary.

Tamp thoroughly in place.

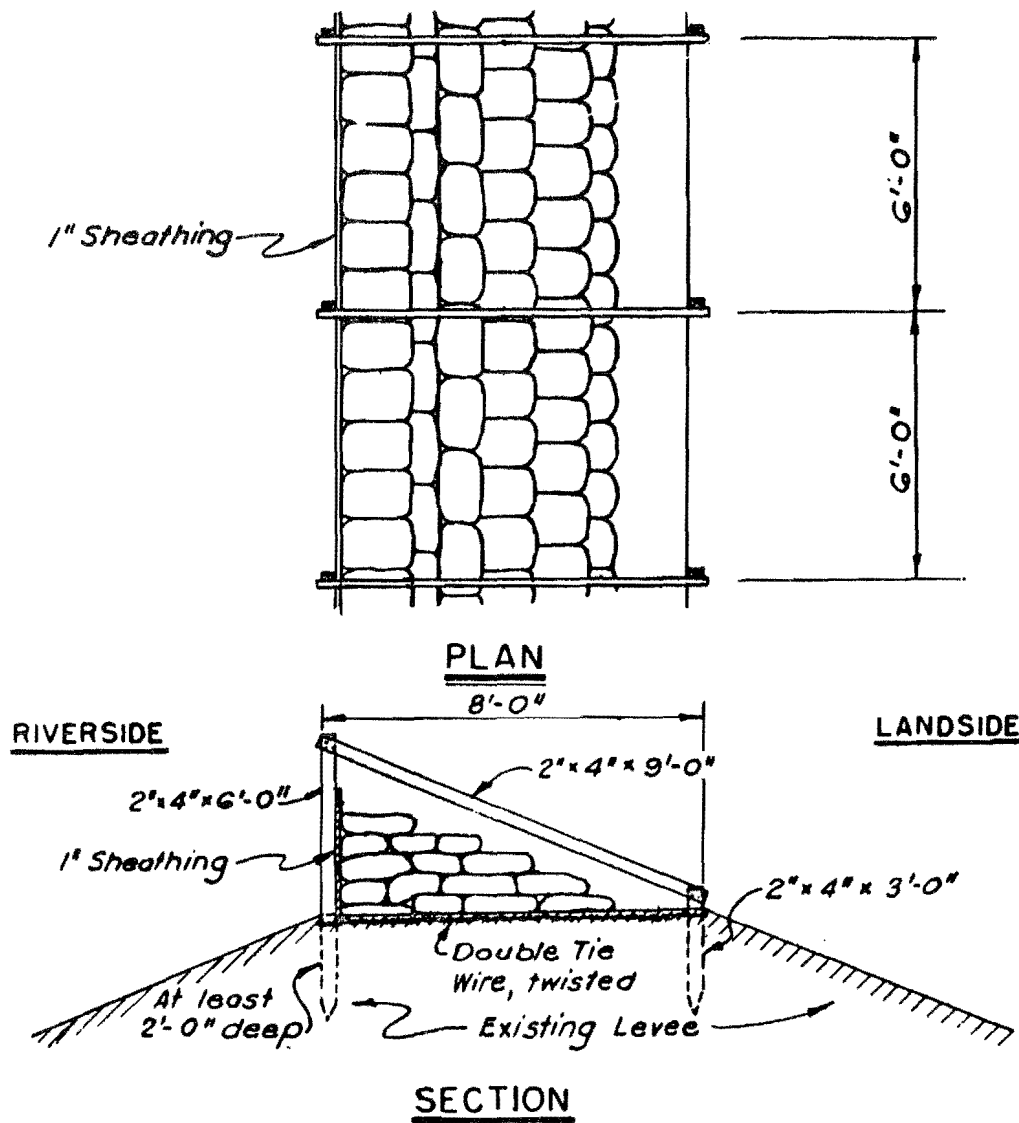
Bags should be approximately $\frac{1}{2}$ full of clay, silt or sand.

**METHOD OF LAPPING SACKS**

BAGS REQUIRED FOR 100 LINEAR FEET OF LEVEE	
HEIGHT ABOVE LEVEE	BAGS REQUIRED
1 FT.	800
2 FT.	2,000
3 FT.	3,400

HIGH WATER MAINTENANCE**SACK TOPPING**

CORPS OF ENGINEERS, U. S. ARMY
NEW YORK DISTRICT
NEW YORK, N. Y.

BILL OF MATERIAL TO CONSTRUCT 100 FT.Lumber

300 Sq. Ft. - 1" Sheathing

17 Pieces - 2" x 4" x 9'-0"

17 Pieces - 2" x 4" x 6'-0"

17 Pieces - 2" x 4" x 3'-0"

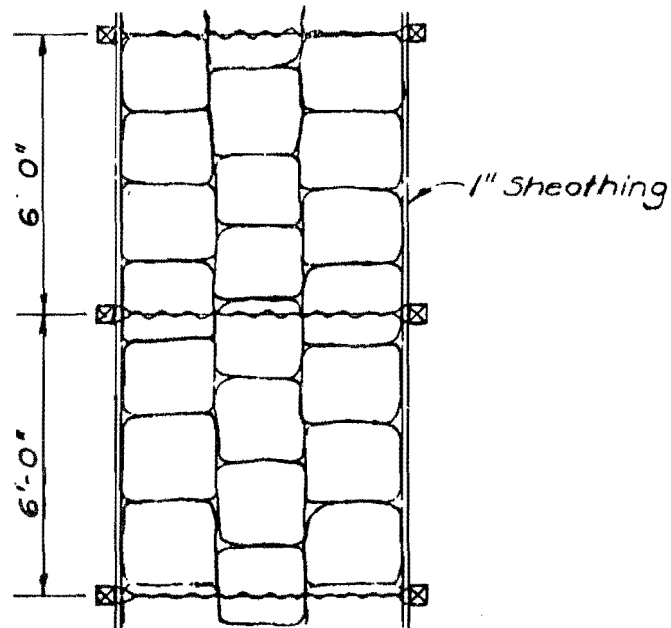
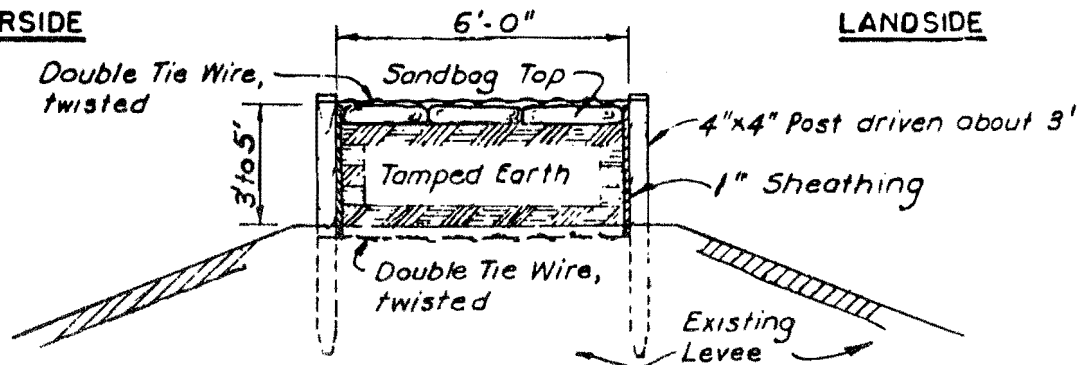
15 lbs. # 12 Gage Wire

4 lbs. 10 d Nails

4 lbs. 16 d Nails

1300 Sandbags

**3 FT TIMBER AND
SANDBAG LEVEE**CORPS OF ENGINEERS, U. S. ARMY
NEW YORK DISTRICT
NEW YORK, N. Y.

PLANRIVERSIDELANDSIDESECTION

BILL OF MATERIAL TO CONSTRUCT 100 FT.

ITEM	UNIT	HEIGHT		
		3	4	5
4" x 4" x 6' to 8' Posts	Each	34	34	34
1" Sheathing	S.F.	600	800	1000
*12 Gage Wire	Lb.	25	25	25
10 d Nails	Lb.	6	8	10
Sandbags	Each	400	400	400
Earth	C.Y.	70	90	110

Note:

Width may be varied but should not be less than the anticipated height.

3 TO 5-FT. MUD-BOX LEVEE

CORPS OF ENGINEERS, U. S. ARMY
NEW YORK DISTRICT
NEW YORK, N. Y.



MADISON TOWNSHIP BEACH EROSION AND HURRICANE PROJECT

Looking east from vicinity of Station 50+00.

PLATE 11

OPERATION AND MAINTENANCE MANUAL
RARITAN BAY AND SANDY HOOK BAY, NEW JERSEY
MADISON TOWNSHIP

BEACH EROSION AND HURRICANE PROJECT

APPENDIX - REFERENCE DATA

DATA FOR PERMANENT ACQUISITION					
POINT	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
1	593673	2114357	1-92	157.00	S27-42-27E
22	593534	2114430	92-93	268.60	S03-50-33E
93	593266	2114448	93-94	53.26	N50-49-56E
94	593300	2114489	94-95	57.98	S67-40-48E
95	593269	2114538	95-96	77.10	S33-53-44W
96	593205	2114495	96-97	43.00	Due South
97	593162	2114495	97-98	316.08	S54-23-57E
8	593405	2114914	8-9	143.39	S17-30-52E
9	593374	2115054	9-10	215.08	S59-51-31E
10	593266	2115240	10-11	244.50	S59-02-10E
8	593405	2114914	8-61	26.69	S34-47-13W
61	593383	2114889	61-62	216.69	S54-46-11E
62	593258	2115076	62-63A	52.70	S33-23-19W
63A	593214	2115047			
98	592978	2114752	98-102	11.18	N63-26-06E
99	593091	2114873	99-100	30.02	N01-54-33W
100	593121	2114828	100-100A	120.81	N17-50-06E
100A	593236	2114865	100A-100B	122.65	N65-56-34E

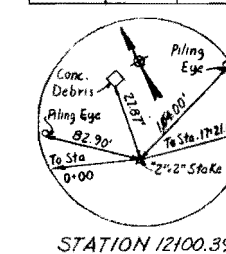
ACQUISITION BY LOCAL INTERESTS		
ITEM	DESCRIPTION	COLOR LEGEND
A	Area of Permanent Rights 5.9 km	
B	Area of Permanent Rights 1.0 km	

WORK TO BE PERFORMED BY LOCAL INTERESTS		
ITEM	DESCRIPTION	COLOR LEGEND
D	Service Road to be raised, Utilities to be raised as reqd	
E	Cliffwood Way to be raised, Utilities to be raised as reqd	
F	Frame Commercial building to be raised	
G	Frame Garage to be raised	
H	1st Frame to be raised	
I	Areas to be filled to E.T.H. 0.1 MSL	
J	Power Lines to be raised	
N	New 9"x20" Curb	
P	Highway Guard Rails	

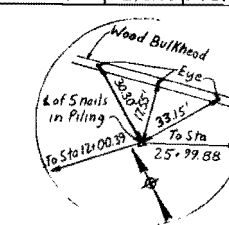
BASE LINE DATA				
STATION	COORDINATES		COURSE	DISTANCE BEARING
	NORTH	EAST		
0+00.00	593376.58	2113586.95	0+00.00-12+00.39	1200.39 S68-20-11E
12+00.39	593433.47	2114702.45	12+00.39-17+21.01	520.62 S79-56-45E
17+21.01	593342.58	2115215.00	17+21.01-25+99.88	878.87 S61-24-06E

DATA FOR PERMANENT ACQUISITION					
POINT	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
101	592983	2114762	102-103	308.20	S55-10-32E
103	592807	2115015	103-104	39.12	N32-28-16V
104	592840	2114994	104-105	159.33	N58-36-16V
105	592923	2114858	105-106	75.80	N53-35-0V
106	592968	2114797	106-107	466.7	N45-00-0V
107	593001	2114764	107-99	111.02	N35-50-16L
100B	593286	2114977	100B-100C	74.06	S55-27-06E
100C	593244	2115038	100C-63A	31.32	S16-41-57E

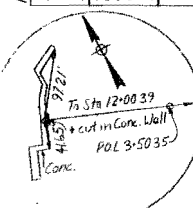
PLAN
Scale: 1"=100'



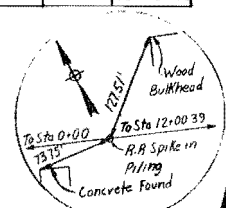
STATION 12+00.39



STATION 17+21.01



STATION 0+00



POL 3+50.35

Approximate Mean High Water Line

REVISION	DATE	DESCRIPTION	BY
1	8-13-65	Per. & Temp. Rights Revised, D.S. 1/1000, D.S. 1/1000	D.S.
2	9-26-65	Permanent & Temporary Rights Revised, D.S. 1/1000, D.S. 1/1000	D.S.
3	7-13-65	Permanent & Temporary Rights Revised, D.S. 1/1000, D.S. 1/1000	D.S.

RARITAN BAY AND SANDY HOOK BAY
BEACH EROSION & HURRICANE PROJECT

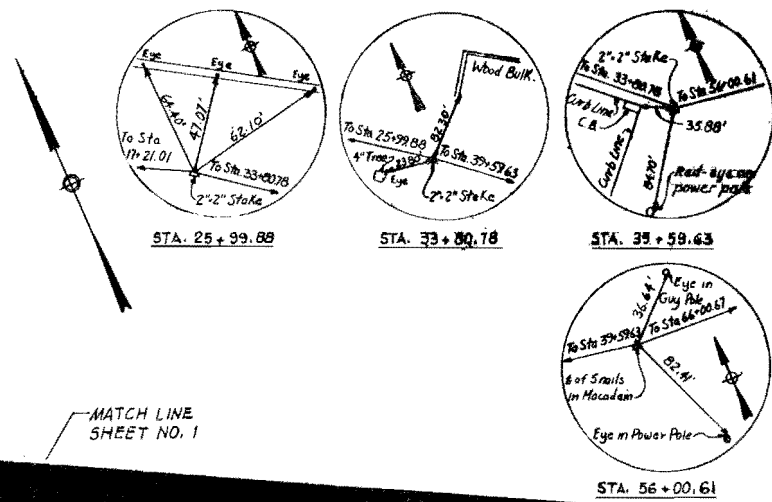
MADISON TOWNSHIP, NEW JERSEY
REAL ESTATE

MADISON TOWNSHIP

NEW JERSEY

APP. 1

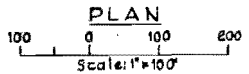
APPENDIX I



POINT	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
10	-	-	10-11	244.90	S 59° 02' 10" E
11	593.140	2.115 450	11-12	180.43	S 77° 11' 46" E
12	593.190	2.115 624	12-13	398.61	S 61° 17' 49" E
13	592.910	2.115 973	13-14	654.14	S 50° 23' 47" E
14	592.493	2.116 477	14-15	156.89	S 72° 57' 03" E
15	592.447	2.116 627	15-16	243.36	S 45° 16' 27" E
16	592.135	2.116 942	16-17	307.42	S 61° 26' 09" E
17	591.988	2.117 212	17-18	263.24	S 73° 08' 27" E
18	591.788	2.117 837	18-19	405.62	S 83° 28' 18" E
19	591.752	2.118 240	19-20	325.10	N 88° 35' 27" E
20	591.760	2.118 560	20-21	104.06	S 47° 43' 35" E
21	591.493	2.118 560	21-22	39.34	S 03° 28' 17" E
22	591.657	2.118 650	22-23	48.64	S 84° 03' 11" E

ACQUISITION BY LOCAL INTERESTS		
ITEM	DESCRIPTION	COLOR LEGEND
A	91 Acres Area of Permanent Rights	
K	1 Story Concrete Block Commercial building to be acquired	
L	1 Story Frame Commercial Building to be acquired	

BASE LINE DATA				
STATION	COORDINATES		COURSE	DISTANCE
	NORTH	EAST		
17+21.01	-	-	17+21.01-25+99.88	878.97
25+99.88	592.9220	2.115 9864	25+99.88-33+80.18	732.90
33+80.18	592.4434	2.116 6028	33+80.18-39+59.63	578.85
39+59.63	592.0536	2.117 0303	39+59.63-56+00.61	144.18
56+00.61	591.7266	2.118 6372	56+00.61-66+00.61	100.06

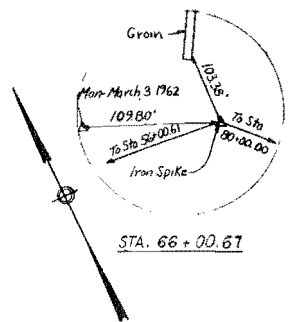


MATCH LINE
SHEET NO. 3

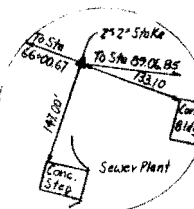
R A R I T A N B A Y



6-23-63	Permanent & Temporary Rights reserved	63
REVISION	DATE	DESCRIPTION
RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY REAL ESTATE MADISON TOWNSHIP NEW JERSEY		



STA. 66+00.67

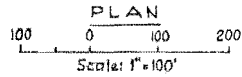


STA. 80+00.00

STATION	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
66+00.67	-	-	86+00.61-66+00.67	1000.06	S 84°22'45"E
66+00.67	591 623.16	2 119 631.54	66+00.67-80+00.00	1 339.33	S 42°52'52"E
80+00.00	590 604.38	2 120 553.34	80+00.00-89+06.85	906.88	S 54°49'23"E
89+06.85	690 083.33	2 121 324.05	89+06.85-92+05.84	358.99	S 60°57'09"E

POINT	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
20	591 709	2 118 747	21-22	67.42	S 69°08'44"E
21	591 688	2 118 830	21-23	242.48	S 61°36'18"E
22	591 687	2 119 070	22-23	168.94	N 48°29'00"E
23	591 798	2 119 192	23-24	483.96	S 79°02'30"E
24	591 648	2 119 830	24-25	478.17	S 39°17'22"E
25	591 329	2 119 091	25-26	600.40	S 49°58'30"E
26	590 908	2 120 322	26-27	387.33	S 50°41'25"E
27	591 680	2 120 622	27-28	384.19	S 38°30'44"E
28	590 889	2 120 848	28-29	841.51	S 58°06'25"E
29	589 948	2 121 584	29-30	195.53	S 79°05'30"E
30	-	-	30-31	48.24	S 84°10'11"E
31	591 652	2 118 688	31-32	40.31	N 6°05'30"E
32	591 692	2 118 747	32-33	75.93	N 77°03'43"E

ACQUISITION BY LOCAL INTERESTS		
ITEM	DESCRIPTION	LEGEND
A	Area of Permanent Rights 6.8 Acres	



MATCH LINE SHEET NO. 2

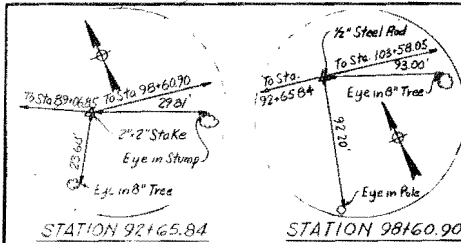
MATCH LINE SHEET NO. 4

Approximate Mean High Water Line

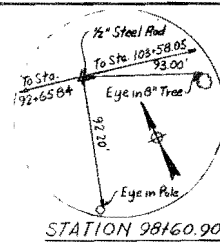


6.25.42	Permanent and Temporary Rights re: 533	22
REVISION	DATE	DESCRIPTION
RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY REAL ESTATE MADISON TOWNSHIP NEW JERSEY		

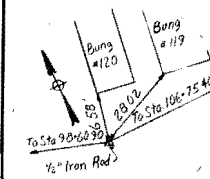
APP. 3



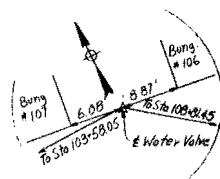
STATION 92+65.84



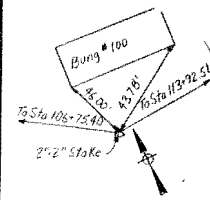
STATION 98+60.90



STATION 103+58.05



STATION 106+75.40



STATION 108+14.90

MATCH LINE
SHEET NO. 3

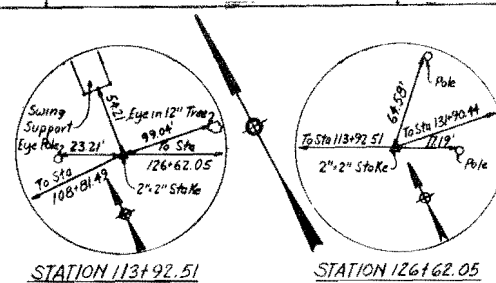
DATA FOR PERMANENT ACQUISITION					
POINT	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
29	-	-	29-30	195.53	S79-05-32E
30	589881	2121776	30-31	63.06	S14-41-50E
31	589820	2121792	31-32	272.66	S86-00-15E
32	589801	2122064	32-33	503.25	S72-53-50E
33	589653	2122545	33-34	155.05	N89-20-00E
34	589671	2122699	34-35	39.81	N11-35-32E
35	589710	2122707	35-36	71.34	N84-22-10E
36	589717	2122778	36-37	170.76	N71-33-54E
37	589771	2122940	37-38	210.92	S71-28-45E
38	589704	2123140	38-39	55.80	S53-44-46E
39	589671	2123185	39-40	90.92	S29-40-00E
40	589592	2123230	40-41	226.14	N87-58-22E

DATA FOR PERMANENT ACQUISITION					
POINT	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
41	589600	2123456	41-42	318.06	N87-56-08W
42	589881	2123307	42-43	430.85	N64-54-53W
43	590036	2122905	-	-	-
44	590320	2122819	44-45	132.65	S40-24-50E
45	590219	2122905	45-46	379.20	S70-46-10E
46	590094	2123263	46-47	654.81	S49-38-41E
47	589670	2123762	47-48	314.64	S45-45-12E
48	589400	2124306	48-49	566.61	S69-00-22E
49	589197	2124835	49-50	109.58	N67-25-14E
50	589239	2124936	50-51	260.50	S65-00-30E

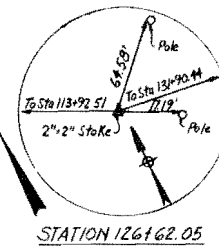
R A R I T A N

82	589530	2124044	82-83	123.13	S20-54-44W
83	589415	2124000	83-84	48.38	S71-54-22E
84	589400	2124046	84-85	117.75	N82-53-52E
85	589510	2124088	85-86	244.78	S61-13-30E

ACQUISITION BY LOCAL INTERESTS		
ITEM	DESCRIPTION	COLOR/LEGEND
A	Area of Permanent Rights	M.I. Acres



STATION 113+92.51



STATION 126+62.05

PLAN
Scale: 1"=100'

BASE LINE DATA					
STATION	COORDINATES		COURSE	DISTANCE	BEARING
	NORTH	EAST			
89+06.85	-	-	89+06.85-92+65.84	358.99	S60-57-09E
92+65.84	589908.18	2121637.68	92+65.84-98+60.90	595.06	S78-43-40E
98+60.90	589792.12	2122220.91	98+60.90-103+58.05	497.15	S76-48-26E
103+58.05	589678.81	2122704.63	103+58.05-106+75.40	317.35	N86-39-48E
106+75.40	589697.48	2123021.27	106+75.40-108+14.90	206.09	S56-50-13E
108+14.90	589584.89	2123193.67	108+14.90-113+92.51	511.02	N89-07-28E
113+92.51	589592.86	2123704.33	113+92.51-126+62.05	126.54	S64-31-18E
126+62.05	589047.28	2124849.65	126+62.05-134+90.44	528.39	S83-12-34E

MATCH LINE
SHEET NO. 5

B A Y

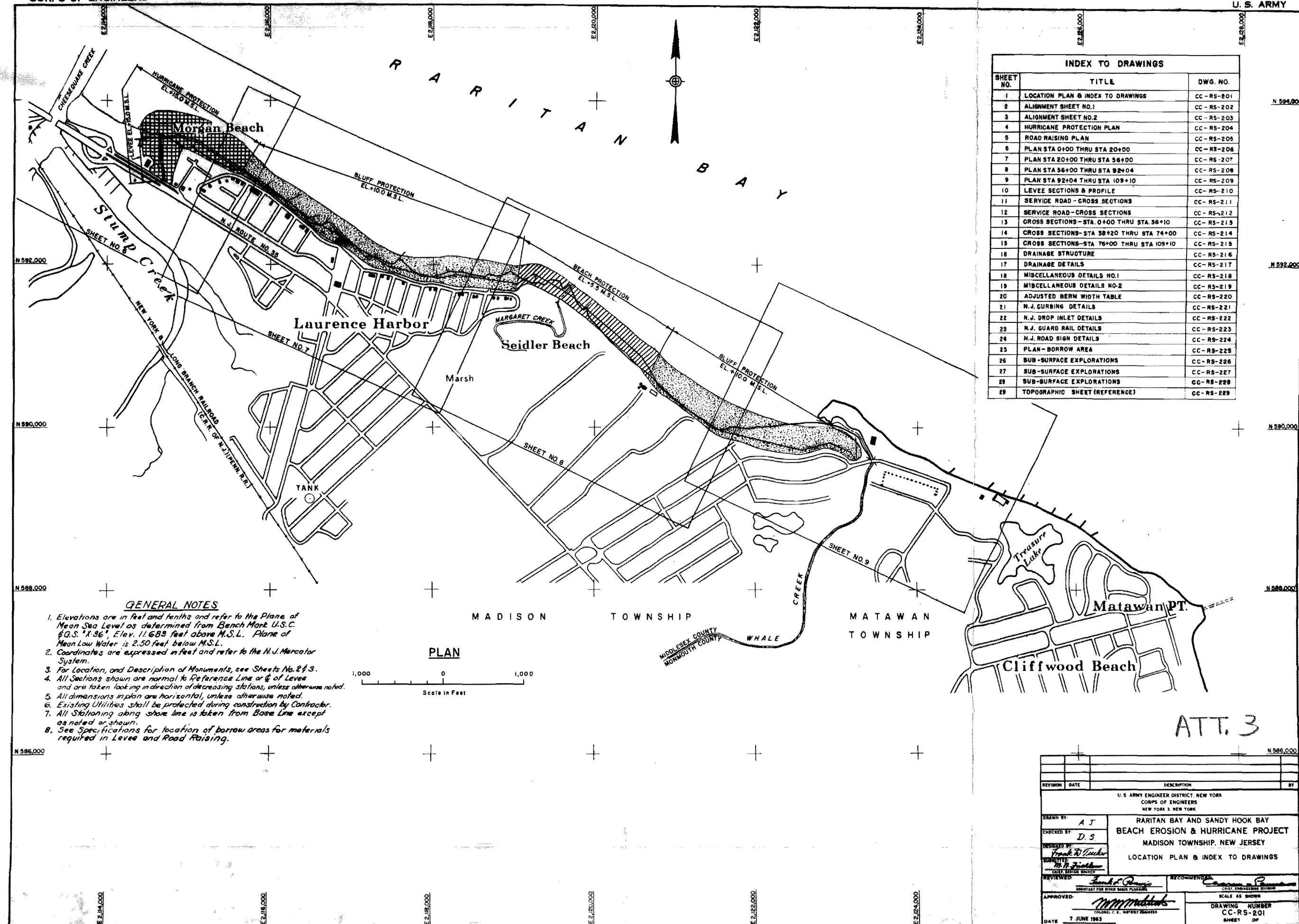
Approximate Mean High Water Line

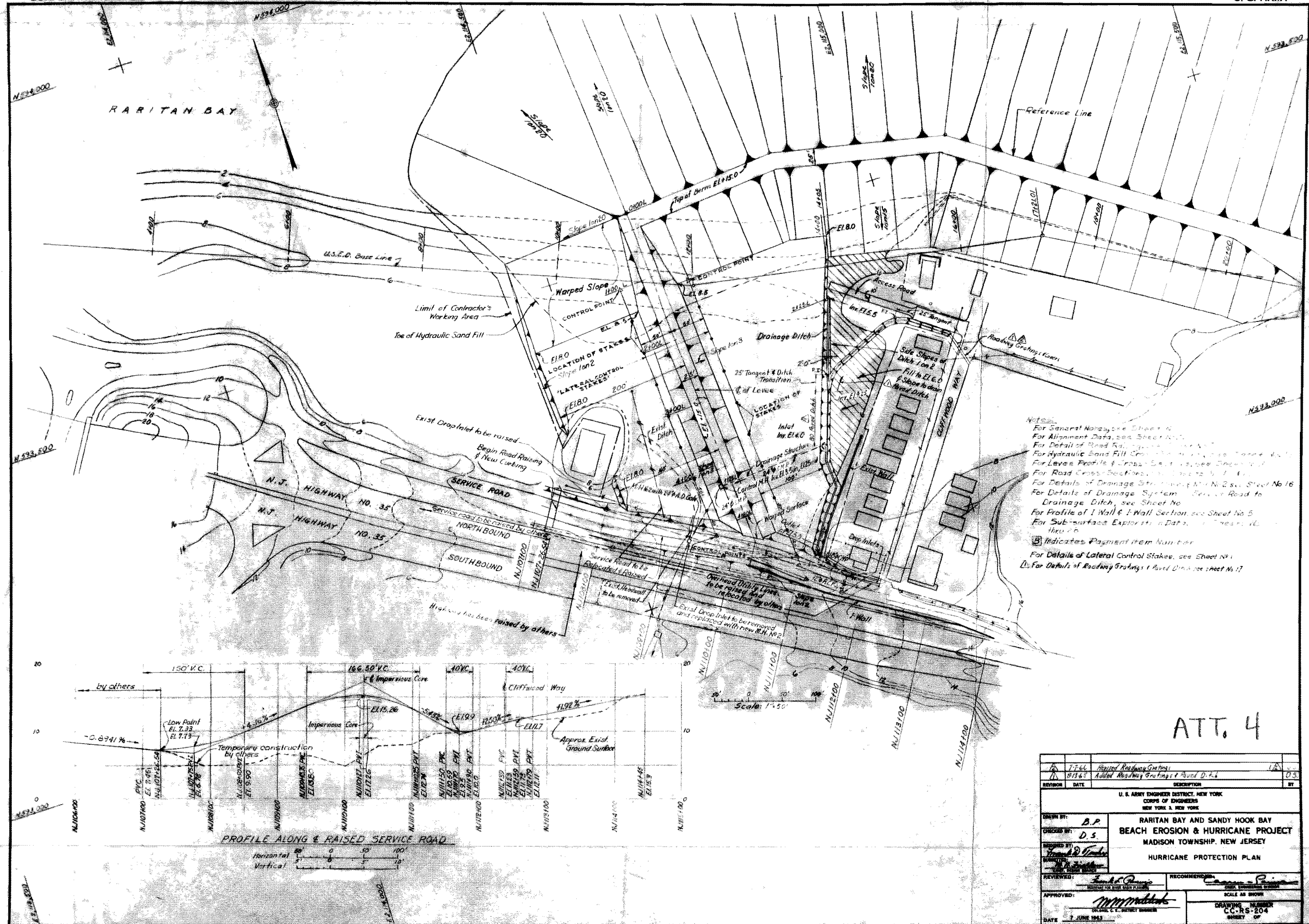
REVISION	DATE	DESCRIPTION	BY
1	6-15-61	Permanent & Temporary Right of Way	
RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY REAL ESTATE MADISON TOWNSHIP NEW JERSEY			

APP. 4

APPENDIX 4

Drawings Attached with Interim Instructions





ATT. 4

7-66 91363 Revised Roadway Gratings Added Roadway Gratings & Guard D. 2.6		12	03
REVISION	DATE	DESCRIPTION	BY
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK			
DRAWN BY: B.P. CHECKED BY: D.S. DESIGNED BY: Frank D. Fisher SANITARY: W. H. Fisher CIVIL: W. H. Fisher		RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROTECTION MADISON TOWNSHIP, NEW JERSEY HURRICANE PROTECTION PLAN	
REVIEWED: Frank D. Fisher ASSISTANT CIVIL ENGINEER		RECOMMENDED: William H. Fisher ASSISTANT CIVIL ENGINEER	
APPROVED: <i>mmmmmmmm</i> COLONEL & DISTRICT ENGINEER		SCALE AS SHOWN DRAWING NUMBER CC-RS-204 SHEET OF	
DATE 7 JUNE 1963			

NOTES:
For General Notes, see Sheet No. 1
For Alignment Data, see Sheet No. 2 (① indicates Alignment Point)
For Cross Sections, see Sheet No. 13
For Sub-Surface Exploration, see Sheets No. 25 thru 28
For Plan (1:10) of Levee, see Sheet No. 4
② indicates Payment Item Number
For Plan of Road, to be Raised, see Sheet No. 5

R A R I T A N B A Y

100' 0 100' 200'
Scale: 1"=100'

HURRICANE PROTECTION

REFERENCE
LINE

MATCH LINE SHEET NO. 7

BASE LINE

MORGAN
BEACH

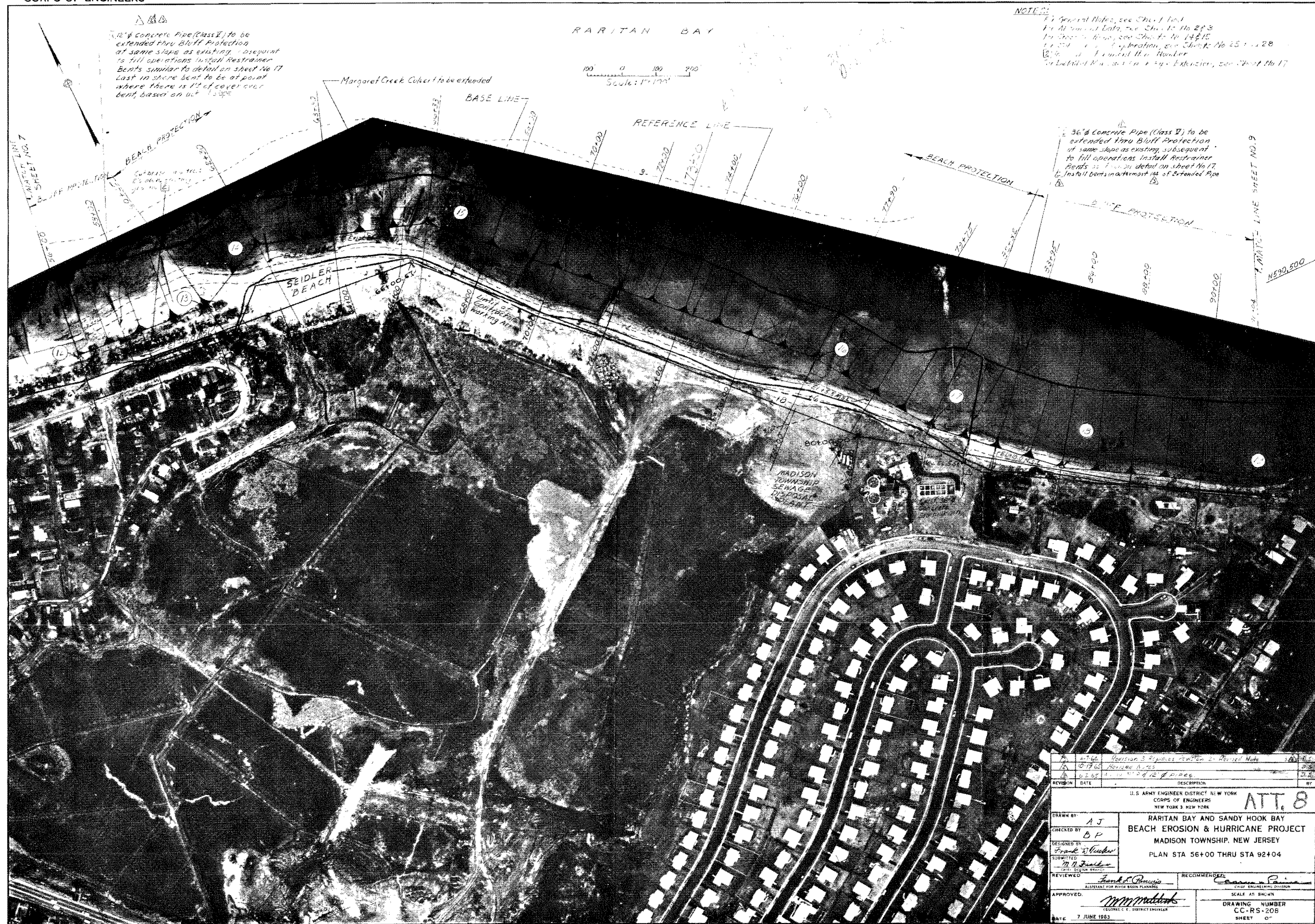
CRIMEE CREEK

NEW YORK & LONG BRANCH R.R.

CHEESECAKE CREEK

REVISION	DATE	DESCRIPTION	BY
ATT. 6			
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK & NEW YORK			
DRAWN BY: D. S.		RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY PLAN STA 0+00 THRU STA 20+00	
CHECKED BY: A. J.			
DESIGNED BY: Frank O. Parker			
SUPERVISOR: M. H. Fadden			
REVIEWED: Frank O. Parker		RECOMMENDED: Frank O. Parker	
APPROVED: M. H. Fadden		SCALE AS SHOWN	
DATE: 7 JUNE 1963		DRAWING NUMBER CC-RS-206 SHEET 6	





U.S. ARMY ENGINEER DISTRICT NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK		ATT. 8	
RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY PLAN STA 56+00 THRU STA 92+00			
DRAWN BY: AJ	CHECKED BY: BP	DESIGNED BY: Frank D. Tucker	SUBMITTED BY: M. J. Zander
REVIEWED BY: Frank D. Tucker	RECOMMENDED BY: Frank D. Tucker	APPROVED BY: M. J. Zander	DATE: 7 JUNE 1983
SCALE: AS SHOWN		DRAWING NUMBER: CC-RS-208 SHEET: 07	

NOTES:

For District Engineer's Office
For Approval of the District Engineer
For Approval of the District Engineer
For Approval of the District Engineer
For Approval of the District Engineer

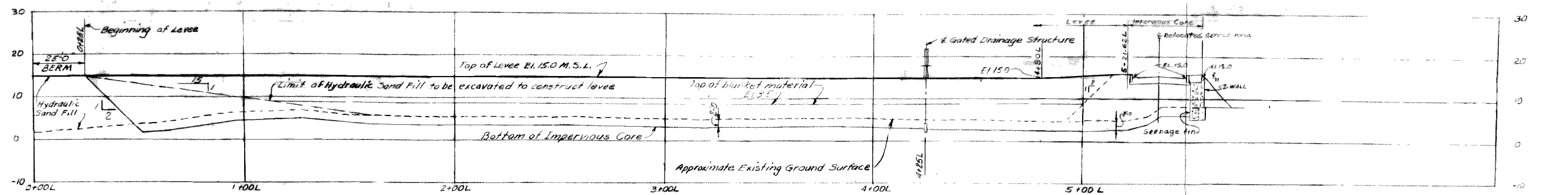
RARITAN BAY

Scale 1" = 100'

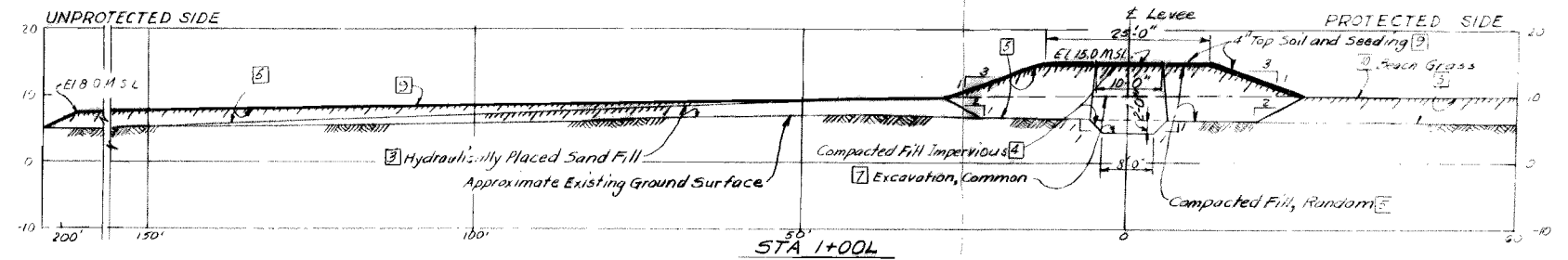
BLUFF EROSION

REVISION		DATE	BY	REASON
1		10/1/58	AS	As per
U. S. ARMY ENGINEER DISTRICT NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK				
DRAWN BY		D.S.		
CHECKED BY		A.J.		
DESIGNED BY		Frank D. Tucker		
SUBMITTED BY		M. H. Fiedler		
REVIEWED BY		Frank D. Tucker		
APPROVED BY		M. H. Fiedler		
DATE		7 JUNE 1963		
RECOMMENDED BY		M. H. Fiedler		
SCALE AS SHOWN		DRAWING NUMBER CC-RS-209 SHEET 01P		

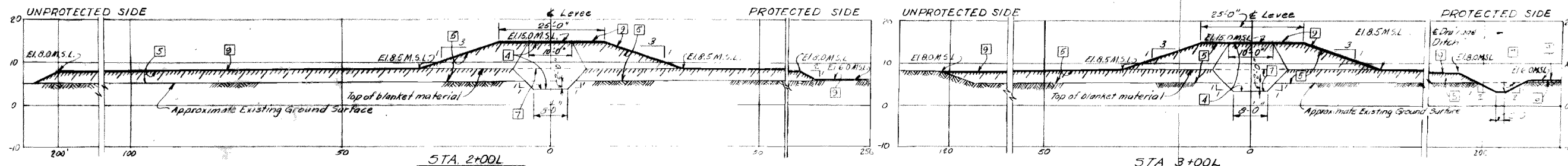
ATTACHMENT 9



PROFILE ALONG 4 OF LEVEE AND IMPERVIOUS CORE

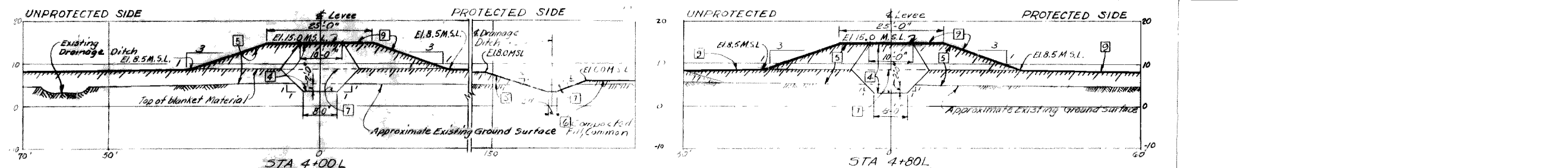


STA 1+00L



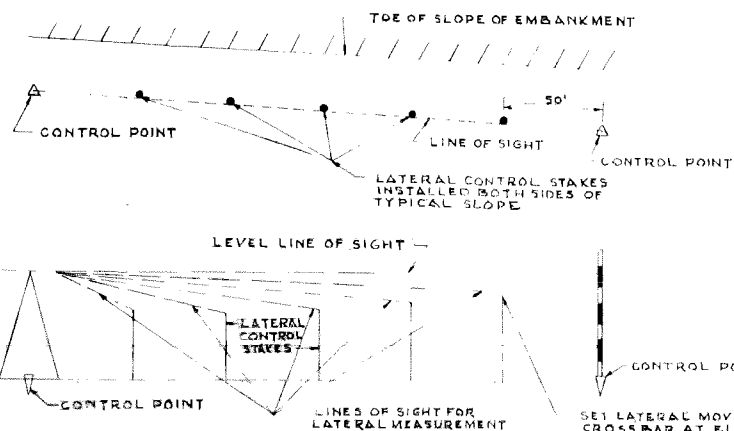
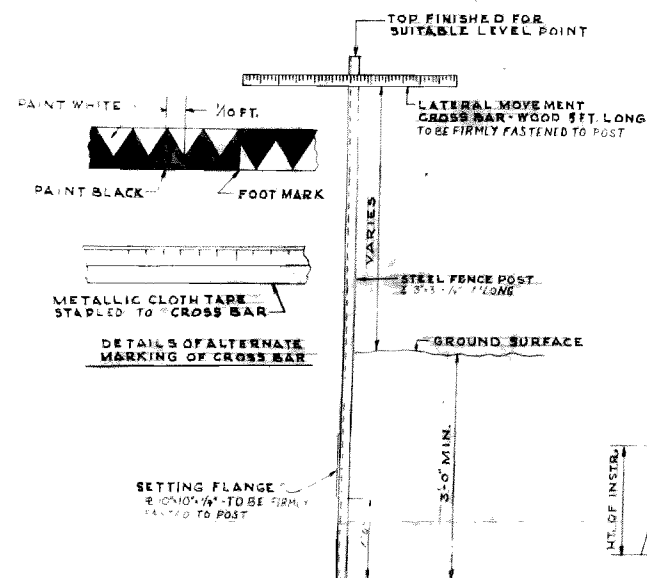
STA 2+00L

STA 3+00L



STA 4+00L

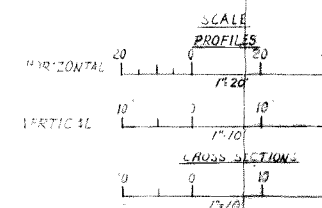
STA 4+80L

LATERAL CONTROL STAKES - SCHEMATIC LAYOUT
NO SCALE

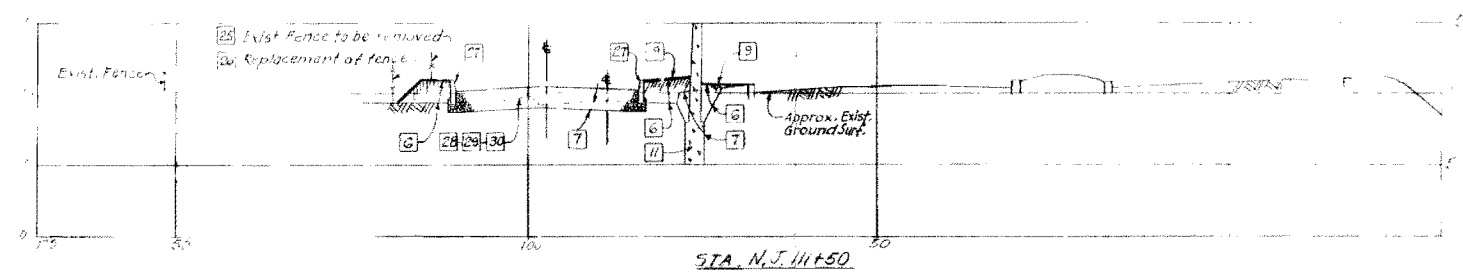
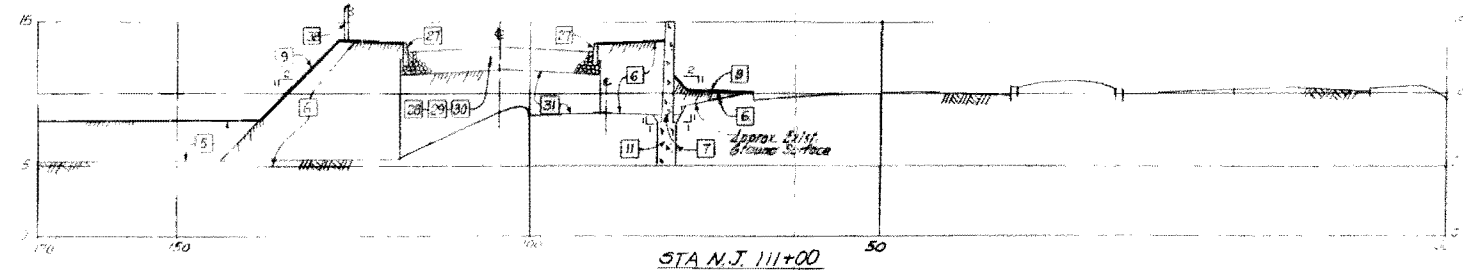
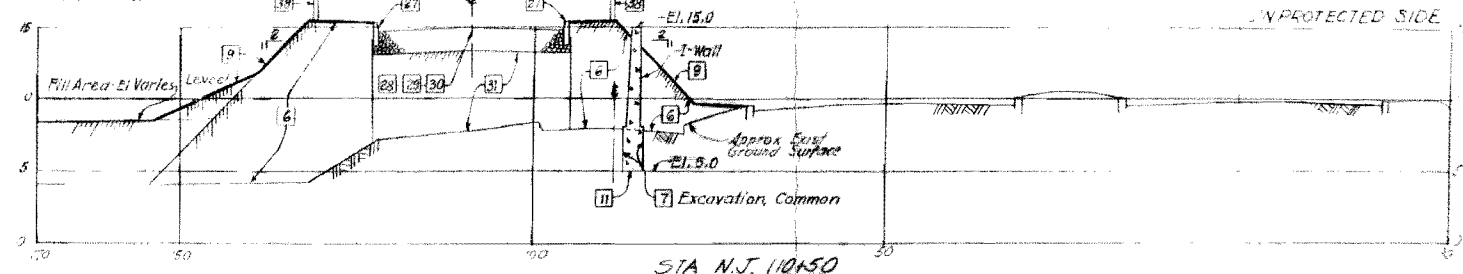
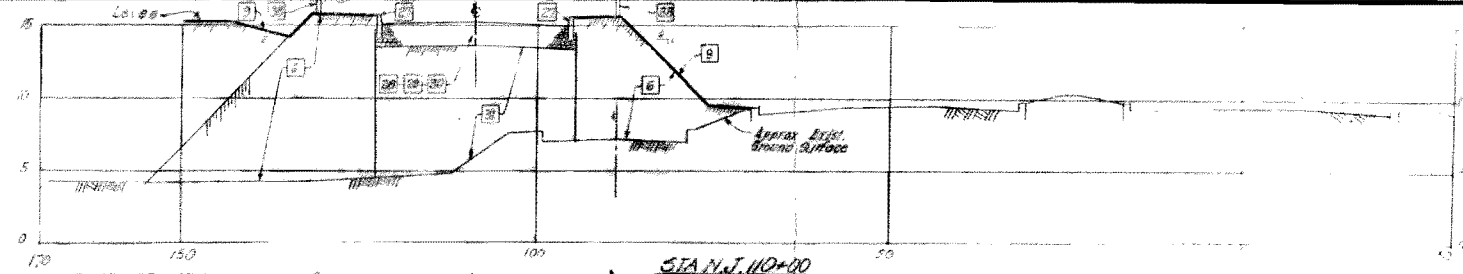
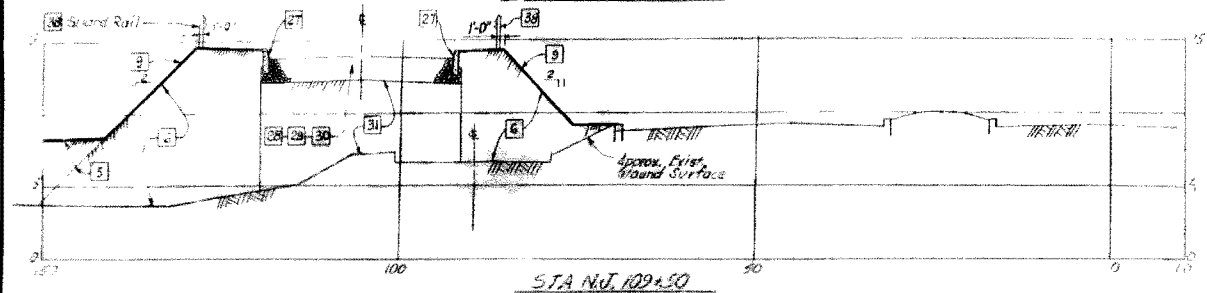
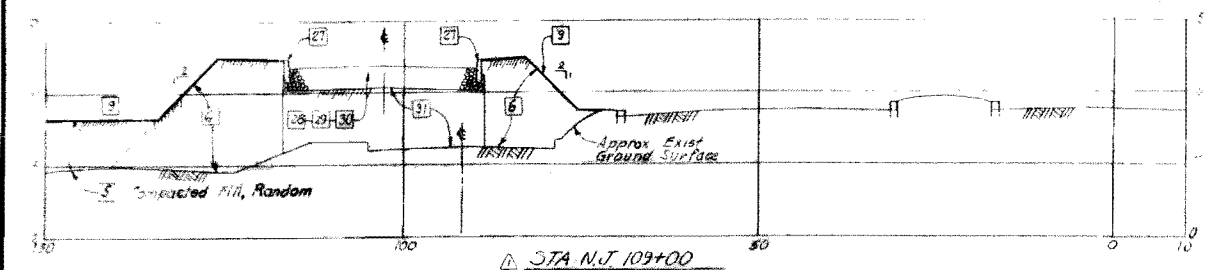
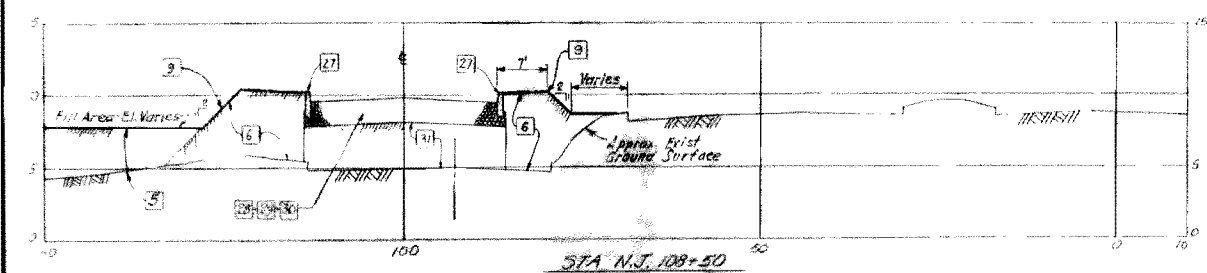
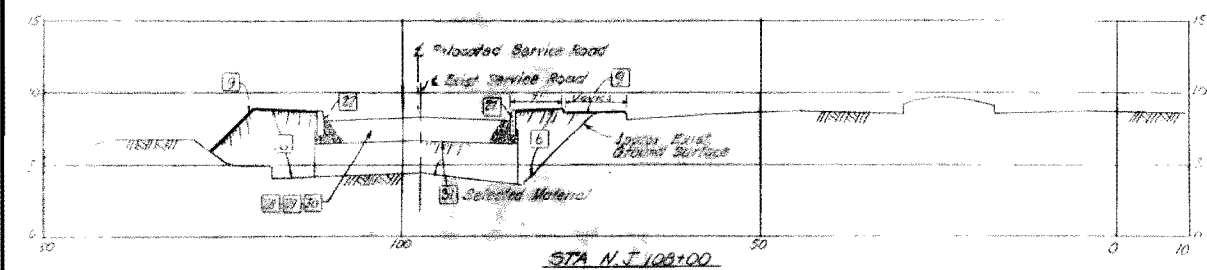
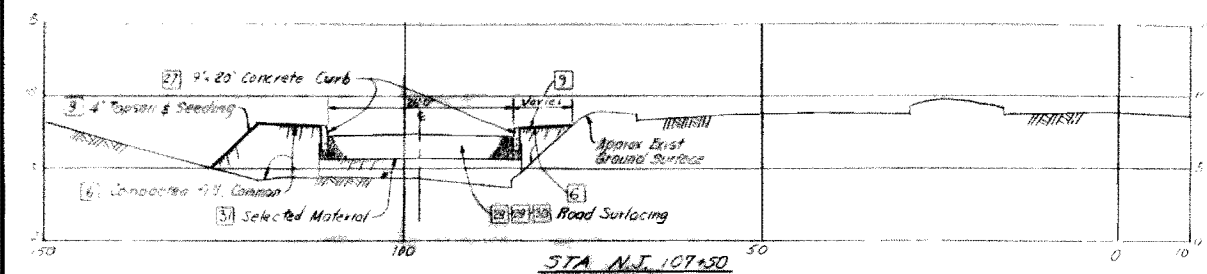
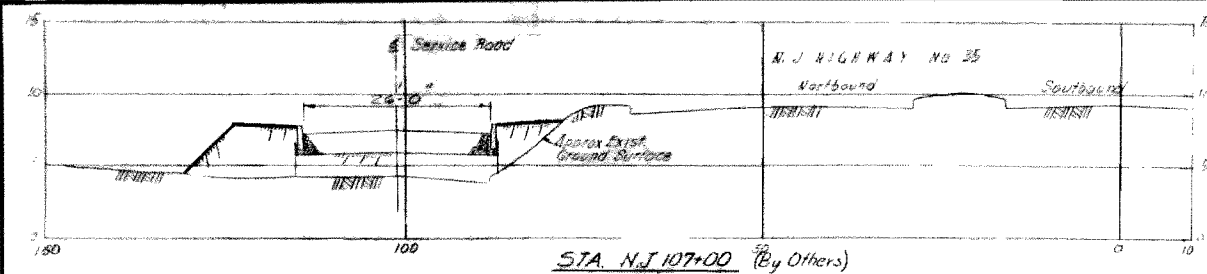
(FOR PLAN SEE SHEET NO 4)

NOTES
For General Notes see Sheet No. 1
For Location of Cross Section see Sheet No. 4

ATT. 10



REVISION	DATE	DESCRIPTION	BY
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK			
DRAWN BY: AJ			
CHECKED BY: BP			
DESIGNED BY: Frank D. Tucker			
SUBMITTED: M. H. Fiedler CHIEF, DESIGN BRANCH			
REVIEWED: Frank D. Tucker CHIEF, ENGINEERING DIVISION			
APPROVED: Colonel C. L. District Engineer			
DATE: 7 JUNE 1963			
SCALE AS SHOWN			
DRAWING NUMBER CC-RS-210 SHEET OF			



Notes:

For General Notes, see Sheet No. 1

For Location of Service Road, see Sheets No. 4, 5 & 6

For Profile of Service Road, see Sheet No. 4

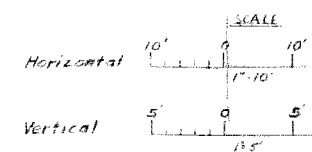
For Typical Service Road Section, see Sheet No. 5

For Details of New Curb, see Sheet No. 21

For Details of New Guard Rail, see Sheet No. 23

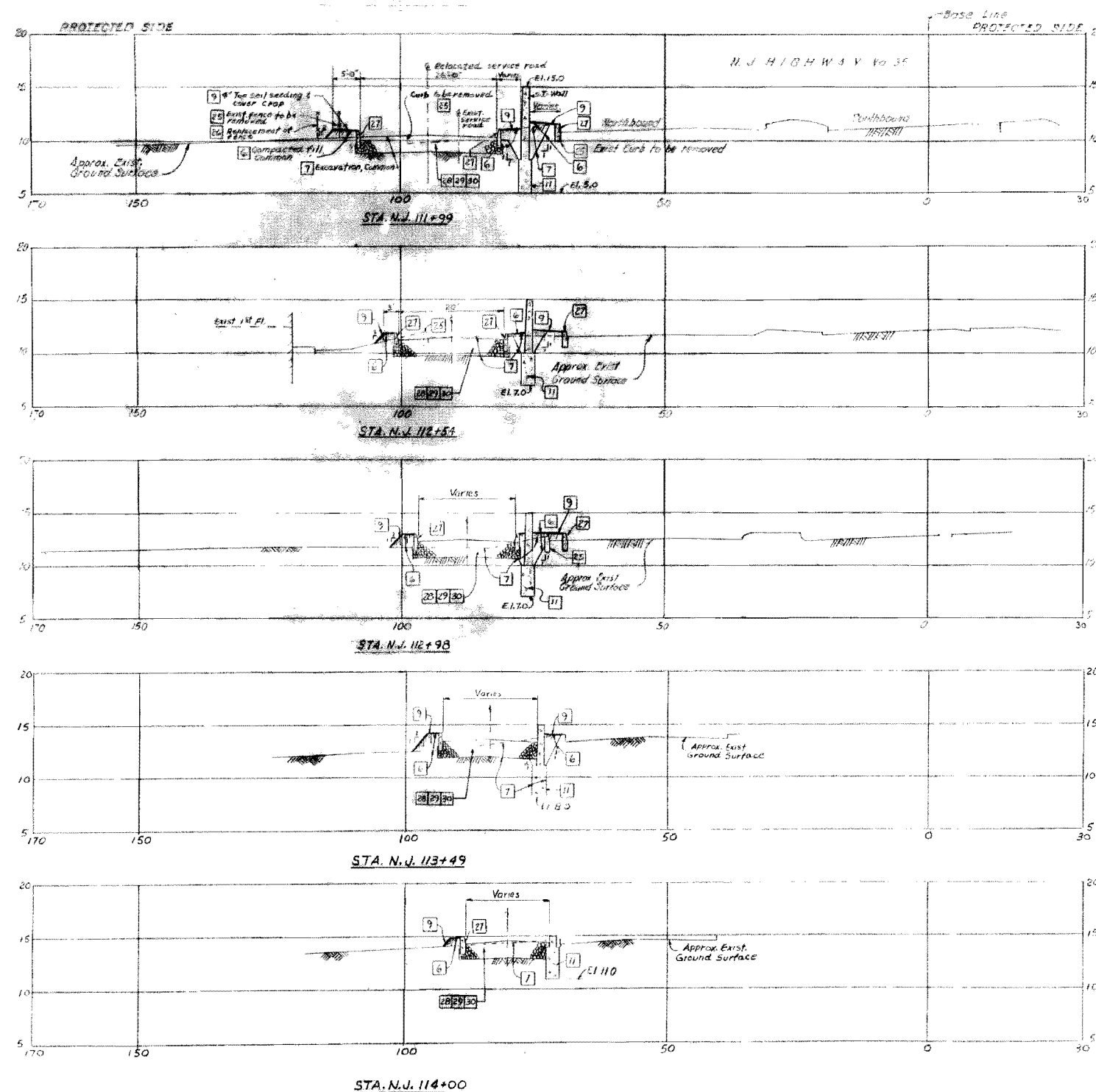
[8] Indicates Payment Item Number

All Cross Sections on this sheet taken looking in direction of increasing stations



ATT. 11

REVISION	DATE	DESCRIPTION	BY
1	2-26-65	Item No. corrected	D.S.
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK			
DRAWN BY: D.S.			
CHECKED BY: A.J.			
DESIGNED BY: Frank D. Winkler			
SUBMITTED: M. H. Fiedler CHIEF, DESIGN BRANCH			
REVIEWED: Frank D. Winkler ASSISTANT FOR RIVER BASIN PLANNING			
RECOMMENDED: [Signature] CHIEF ENGINEERING DIVISION			
APPROVED: [Signature] COLONEL C. E. DISTRICT ENGINEER			
DATE: 7 JUNE 1963			
DRAWING NUMBER CC-RS-211 SHEET OF			



Notes:

For General Notes, see Sheet No. 1

For Location of Road, see Sheet: No. 4, 5 & 6

For Profile of Road, see Sheet No. 4

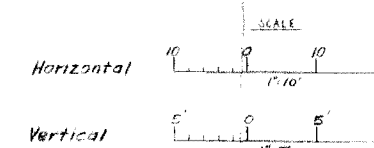
All Cross-Sections on this sheet taken looking in direction of travel.

For Typical Road Section, see Sheet No. 5

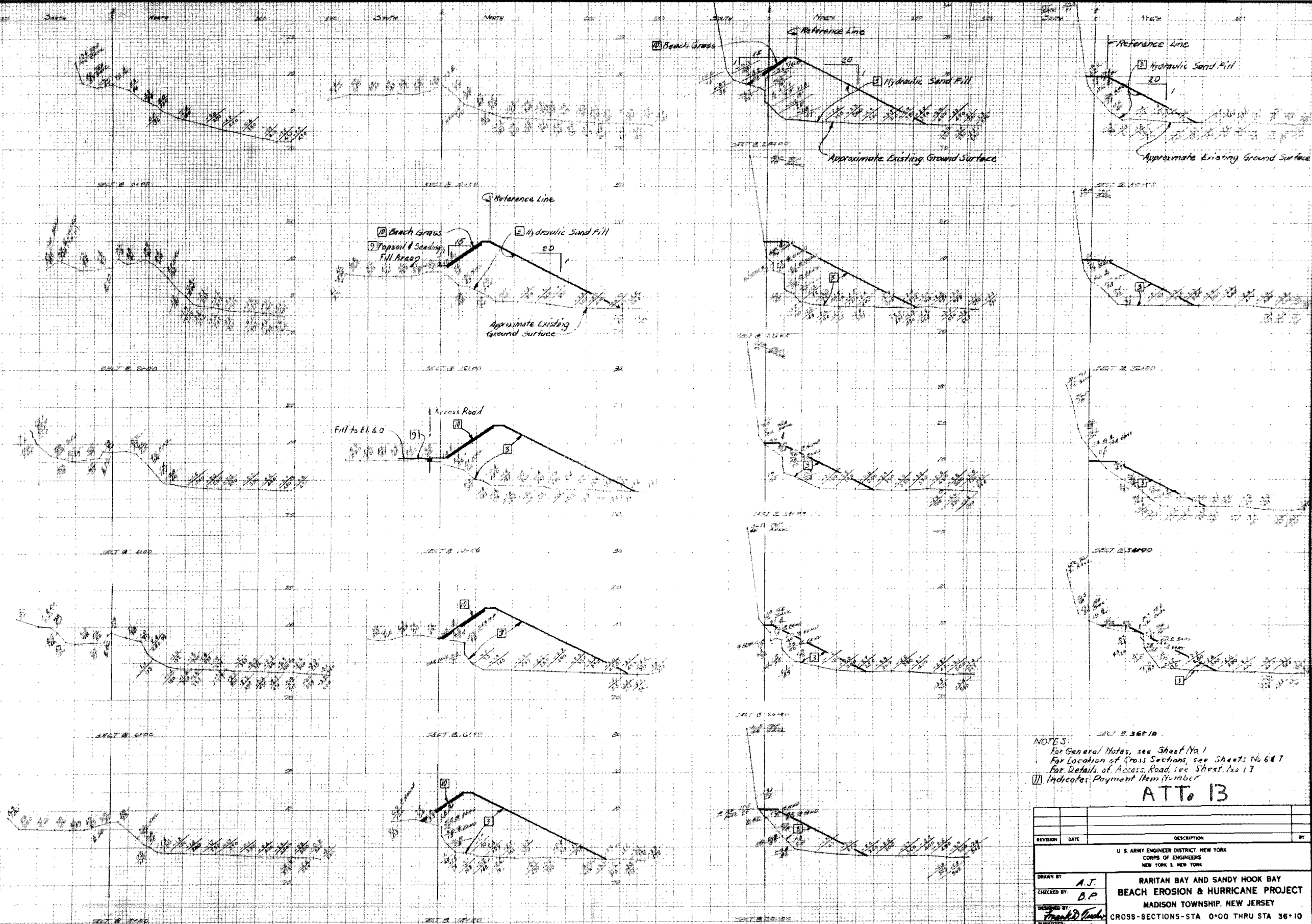
For Details of New Curb, see Sheet No. 1

[6] indicates Payment Item Number

ATT. 12



REVISION	DATE	DESCRIPTION	BY
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK			
DRAWN BY: B.P.		RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY SERVICE ROAD CROSS-SECTIONS	
CHECKED BY: D.S.			
DESIGNED BY: Frank D. Tucker			
SUBMITTED: M. H. Fisher			
REVIEWED: Frank D. Tucker		RECOMMENDED: M. H. Fisher	
APPROVED: M. H. Fisher		SCALE AS SHOWN	
DATE: 7 JUNE 1963		DRAWING NUMBER CC-RS-212 SHEET OF	

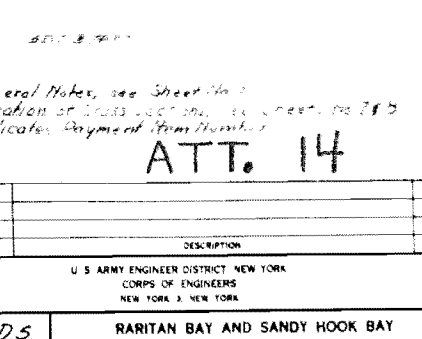
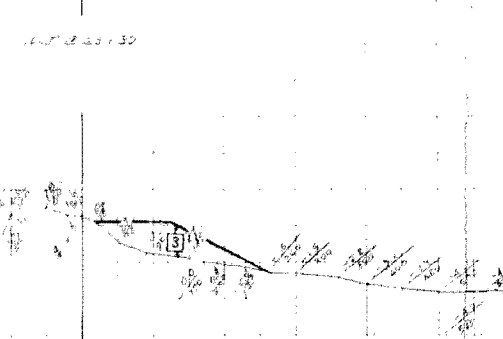
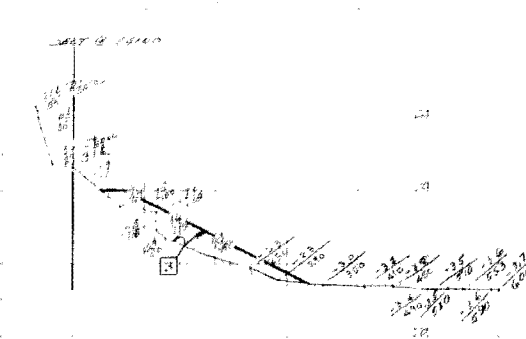
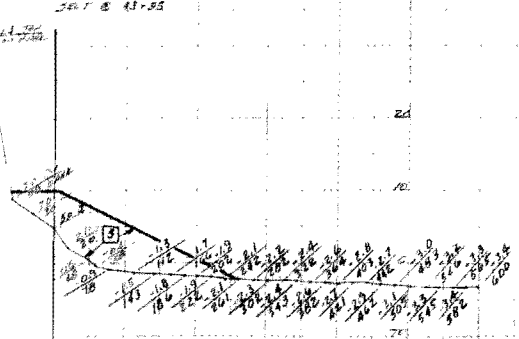
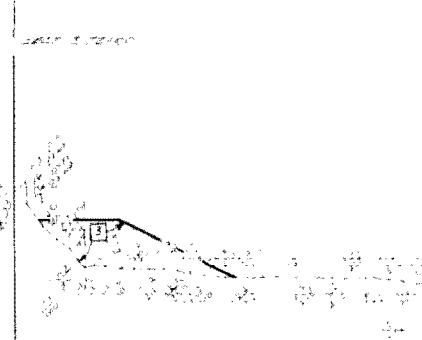
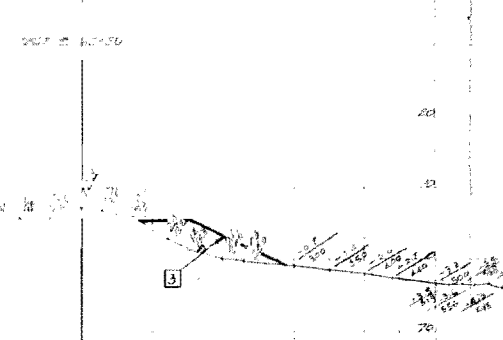
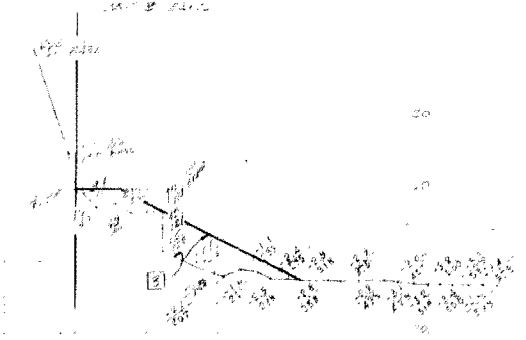
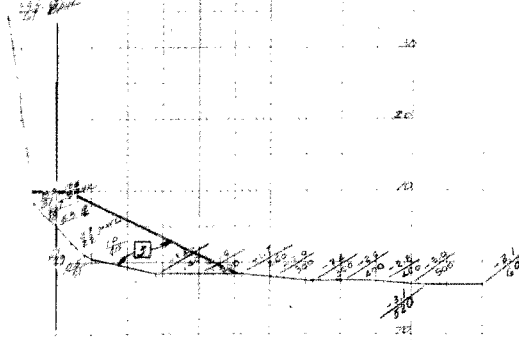
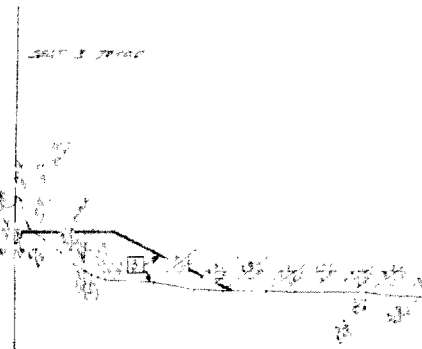
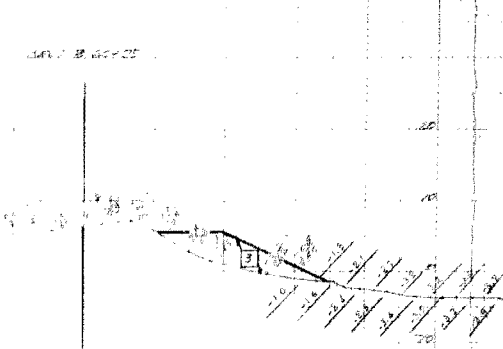
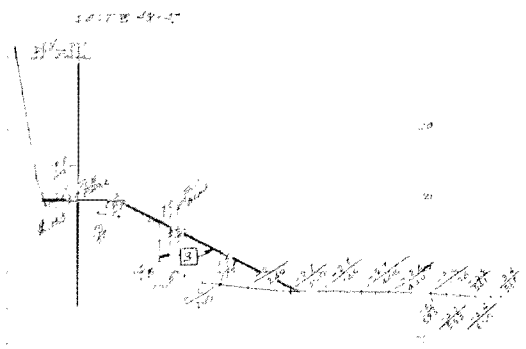
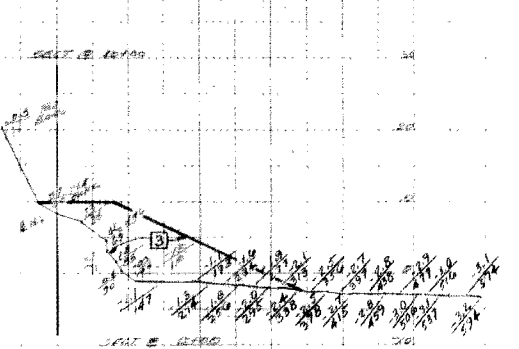
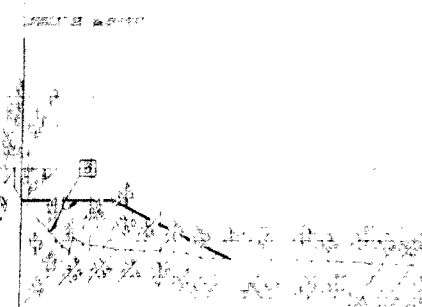
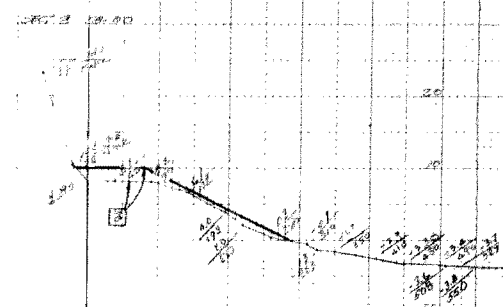
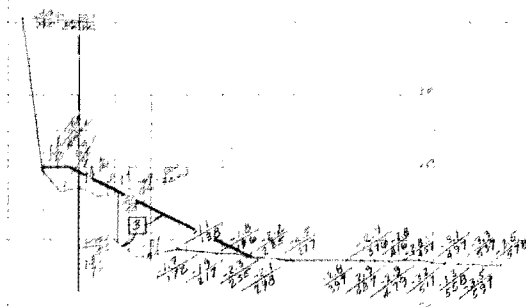
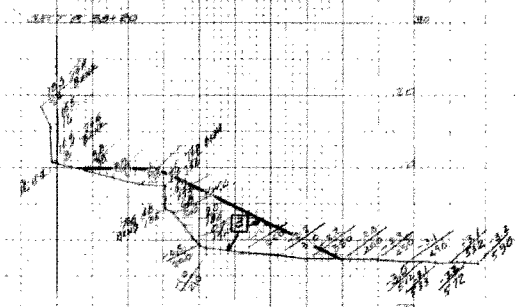
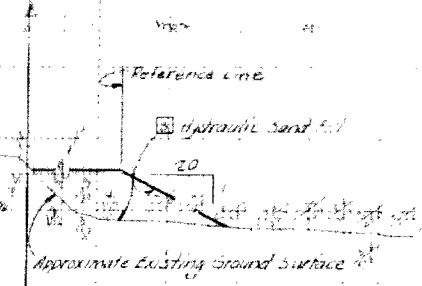
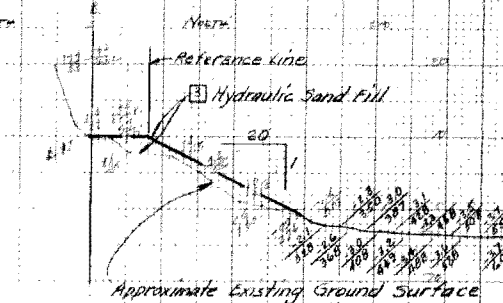
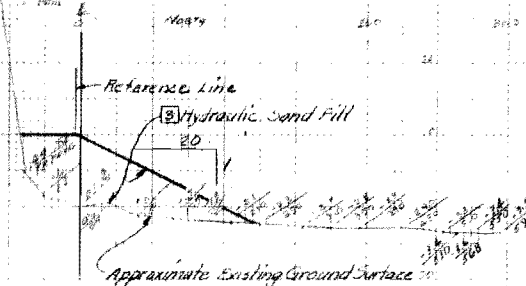
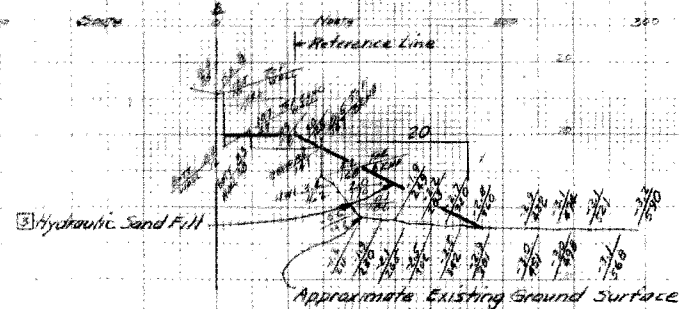


Scale: Horiz: 1"=100'
Vert: 1"=10'

NOTES:
For General Notes, see Sheet No. 1
For Location of Cross Sections, see Sheets No. 6 & 7
For Details of Access Road, see Sheet No. 17
① Indicates Payment Item Number

ATT. 13

REVISION	DATE	DESCRIPTION	BY
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK			
DRAWN BY: A.J.			
CHECKED BY: B.P.			
DESIGNED BY: Frank D. Fisher			
SUPERVISOR: Frank D. Fisher			
REVIEWED: Frank D. Fisher		RECOMMENDED: Frank D. Fisher	
APPROVED: Frank D. Fisher		SCALE AS SHOWN	
DATE: 7 JUN 1963		DRAWING NUMBER: CC-RS-217	
		SHEET OF	

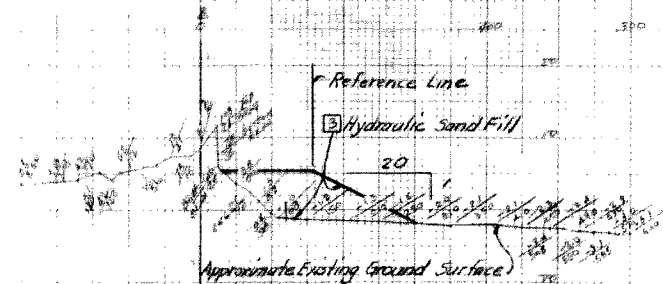


NOTES
 For General Notes, see Sheet No. 1
 For Location of Cross Sections, see Sheet No. 2 & 3
 (1) Indicates Payment from Number

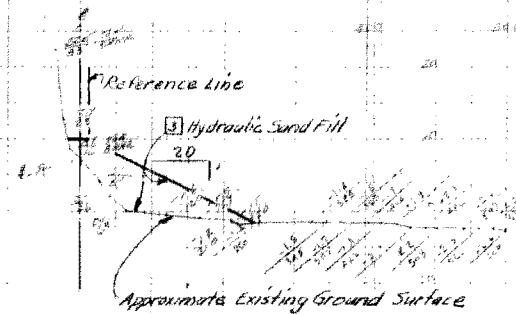
ATT. 14

REVISION	DATE	DESCRIPTION	BY
U. S. ARMY ENGINEER DISTRICT NEW YORK CORPS OF ENGINEERS NEW YORK 3, NEW YORK			
DRAWN BY DS		RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY	
CHECKED BY A.J.		CROSS-SECTIONS- STA 38+20 THRU STA 74+00	
DESIGNED BY Frank D. Tindal			
SUBMITTED BY W. H. Fiedler			
REVIEWED Frank D. Tindal		RECOMMENDED Frank D. Tindal	
APPROVED W. H. Fiedler		SCALE AS SHOWN	
DATE 7 JUNE 1963		DRAWING NUMBER CC-RS-214 SHEET OF	

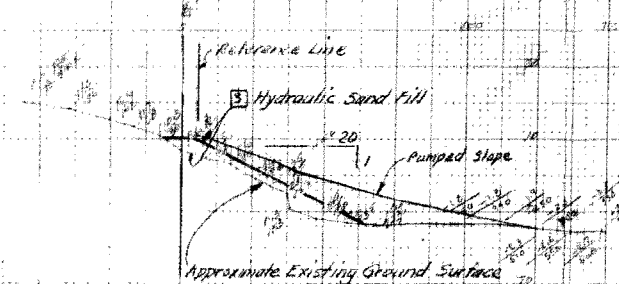
Scales: Horiz: 1"=100'
Vert: 1"=10'



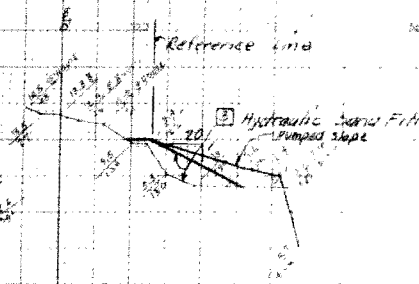
SECT 8 76+00



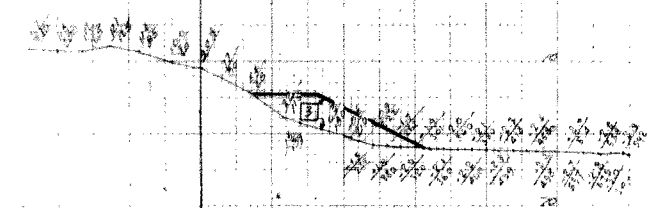
SECT 8 80+00



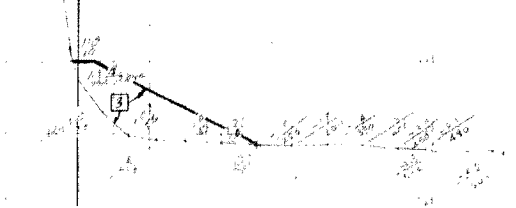
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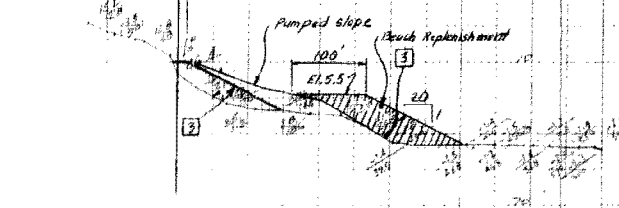
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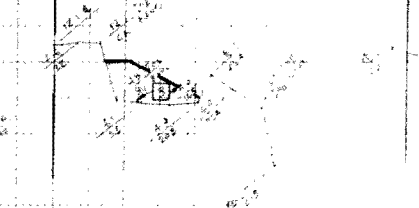
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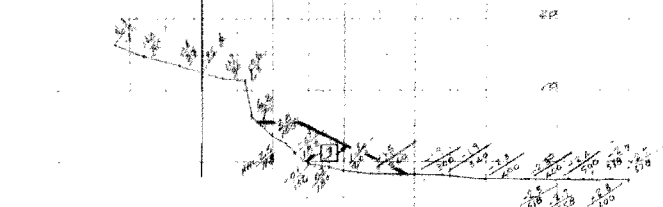
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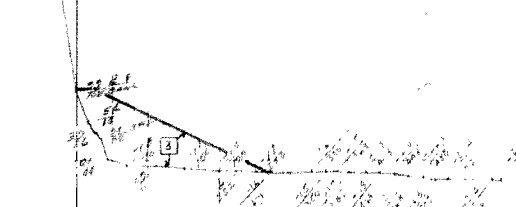
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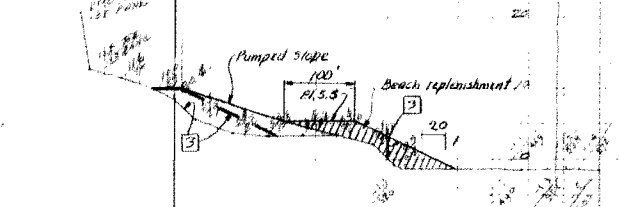
SECT 8 92+00



SECT 8 93+00



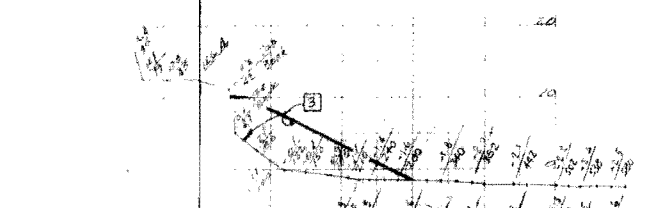
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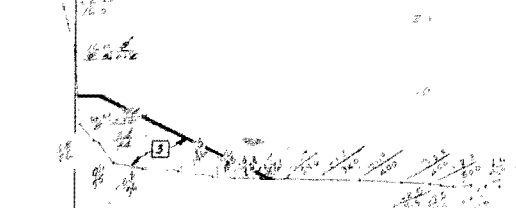
SECT 8 95+00



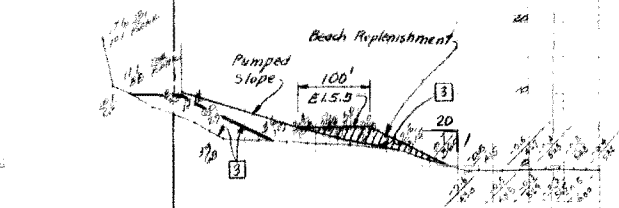
SECT 8 96+00



SECT 8 97+00



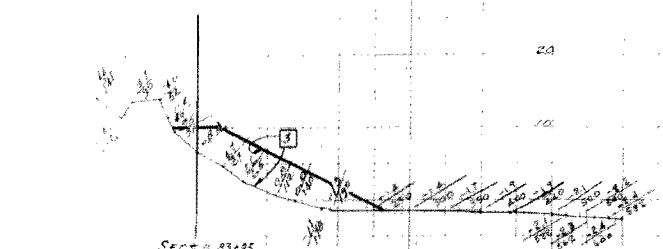
SECT 8 98+00



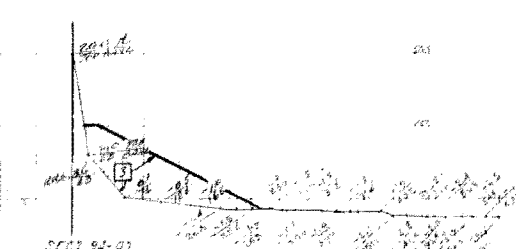
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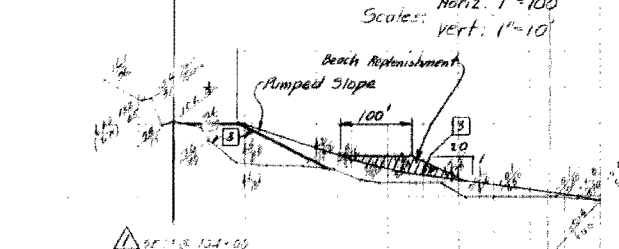
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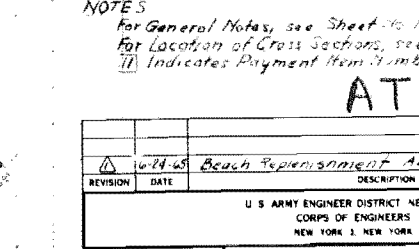
SECT 8 101+00



SECT 8 102+00



SECT 8 103+00



SECT 8 104+00

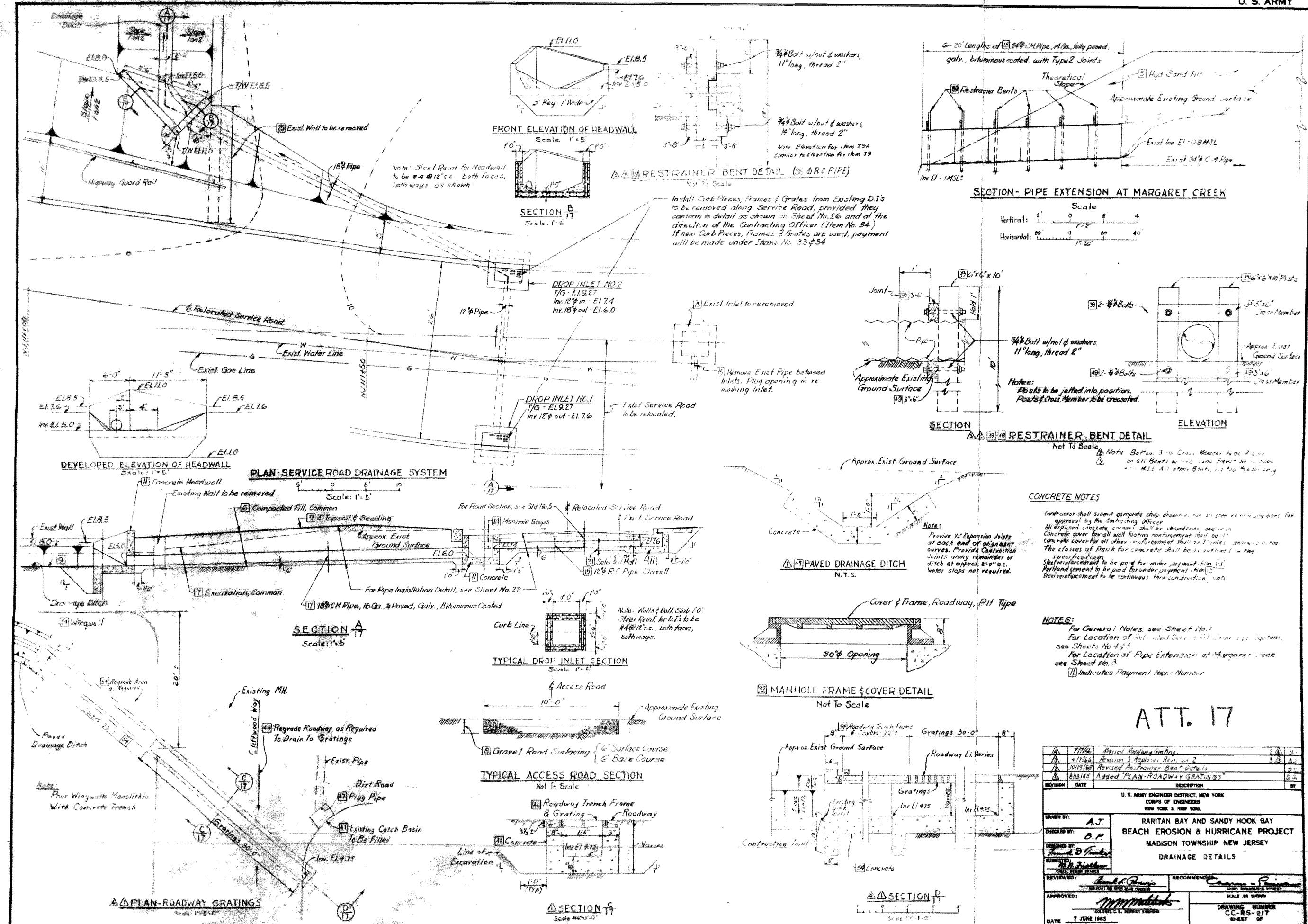
NOTES

For General Notes, see Sheet No. 1
For Location of Cross Sections, see Sheets No. 8 & 9
II Indicates Payment Item Number

ATT. 15

REVISION	DATE	DESCRIPTION	BY
1	10-1-65	Beach Replenishment Added	BT
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK, NEW YORK			
DRAWN BY B.P.		RARITAN BAY AND SANDY HOOK BAY BEACH EROSION AND HURRICANE PROJECT MADISON TOWNSHIP, NEW JERSEY	
CHECKED BY D.S.		CROSS-SECTIONS-STA 76+00 THRU STA 109+10	
DESIGNED BY Frank D. Smith		RECOMMENDED BY James H. Quinn	
SUBMITTED BY W. H. Fiedler		APPROVED BY Colonel C. E. District Engineer	
REVIEWED BY James H. Quinn		SCALE AS SHOWN	
DATE 7 JUNE 1963		DRAWING NUMBER CC-RS-215 SHEET OF	





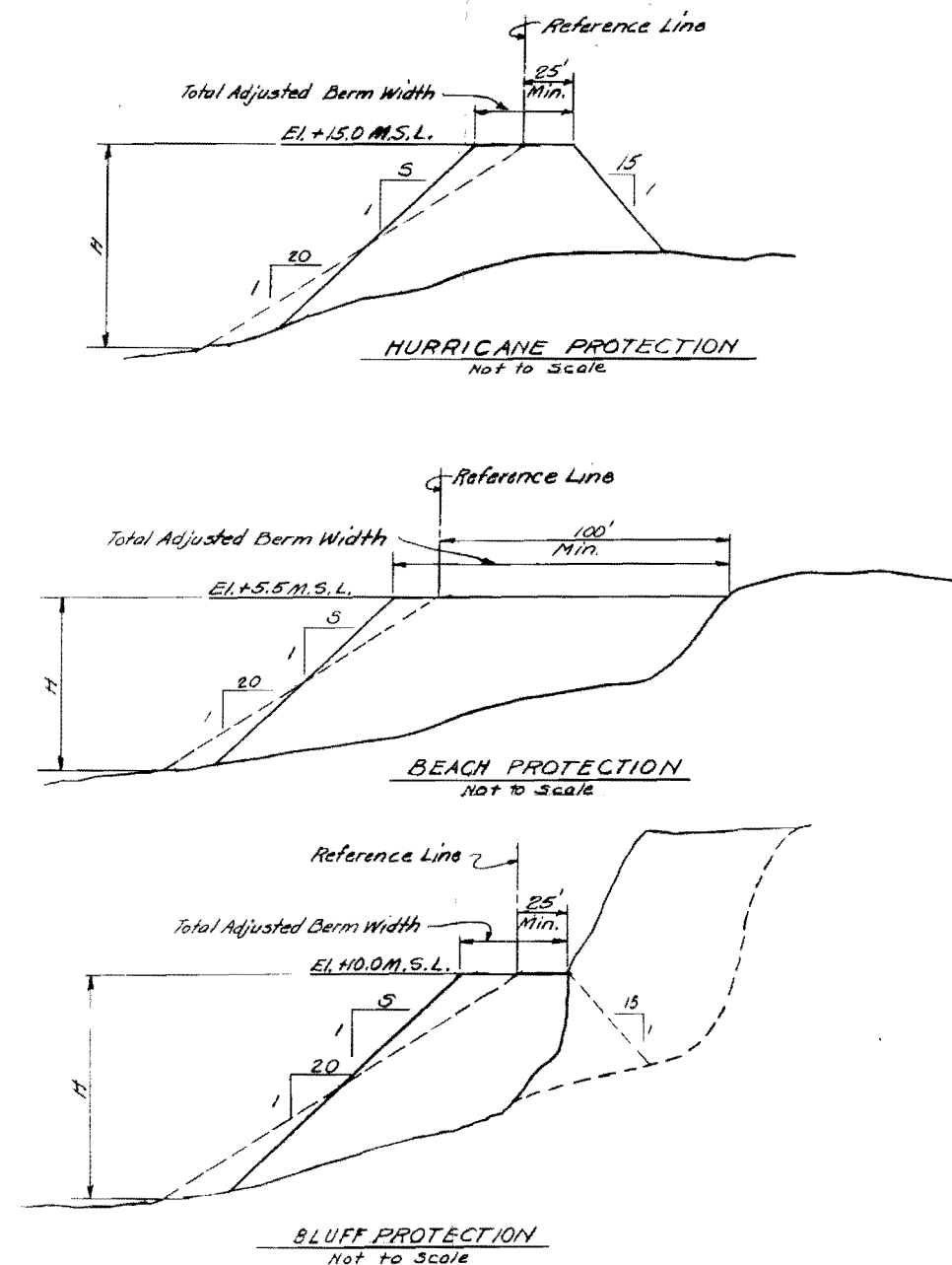
ATT. 17

REVISION	DATE	DESCRIPTION	BY
1	7/1/64	Initial Drawing	24
2	4/1/65	Revision 3 Required	3/2
3	10/1/65	Revised Reinforcement Details	2/2
4	11/1/65	Added "PLAN ROADWAY GRATINGS"	2/2

U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK 1, NEW YORK	
DRAWN BY: A.J.	CHECKED BY: B.P.
DESIGNED BY: M.H. Fisher	APPROVED: [Signature]
RECOMMENDED: [Signature]	
APPROVED: [Signature]	
DATE: 7 JUNE 1965	

RARITAN BAY AND SANDY HOOK BAY BEACH EROSION & HURRICANE PROJECT MADISON TOWNSHIP NEW JERSEY DRAINAGE DETAILS	
SCALE: AS SHOWN	DRAWING NUMBER: CC-RS-217
SHEET OF	

SECTION	H in Feet	TOTAL ADJUSTED BERM WIDTH IN FEET									
		S = 1 on 12	S = 1 on 13	S = 1 on 14	S = 1 on 15	S = 1 on 16	S = 1 on 17	S = 1 on 18	S = 1 on 19	S = 1 on 20	
12+00	18.0	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
14+00	18.2	81.0	72.0	62.0	52.0	42.0	33.0	25.0	25.0	25.0	
16+00	18.2	81.0	72.0	62.0	52.0	42.0	33.0	25.0	25.0	25.0	
18+00	18.2	81.0	72.0	62.0	52.0	42.0	33.0	25.0	25.0	25.0	
20+00	18.0	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
22+00	18.0	78.0	69.0	59.0	50.0	40.0	31.0	22.0	22.0	22.0	
24+00	17.9	78.0	69.0	59.0	50.0	40.0	31.0	22.0	22.0	22.0	
26+00	17.8	81.0	72.0	62.0	52.0	42.0	33.0	25.0	25.0	25.0	
28+00	17.6	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
30+00	17.5	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
32+00	17.4	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
34+00	17.3	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
36+10	17.3	708.0	610.0	510.0	410.0	310.0	210.0	110.0	110.0	110.0	
38+20	17.2	731.0	631.0	531.0	431.0	331.0	231.0	131.0	131.0	131.0	
40+00	17.1	734.0	634.0	534.0	434.0	334.0	234.0	134.0	134.0	134.0	
42+00	17.1	731.0	631.0	531.0	431.0	331.0	231.0	131.0	131.0	131.0	
43+95	17.0	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
46+00	17.1	80.0	71.0	61.0	52.0	42.0	33.0	25.0	25.0	25.0	
48+00	17.3	102.0	92.0	82.0	72.0	62.0	52.0	42.0	32.0	22.0	
49+47	17.3	66.0	56.0	46.0	36.0	26.0	16.0	6.0	6.0	6.0	
52+13	17.7	137.0	130.0	123.0	116.0	109.0	102.0	95.0	88.0	82.0	
54+00	17.8	701.0	601.0	501.0	401.0	301.0	201.0	101.0	101.0	101.0	
56+00	17.8	735.0	635.0	535.0	435.0	335.0	235.0	135.0	135.0	135.0	
58+00	10.9	706.0	606.0	506.0	406.0	306.0	206.0	106.0	106.0	106.0	
60+25	10.0	715.0	615.0	515.0	415.0	315.0	215.0	115.0	115.0	115.0	
62+30	7.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
63+80	6.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
65+33	7.0	103.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
68+00	7.7	126.0	121.0	116.0	111.0	106.0	101.0	96.0	91.0	86.0	
70+00	8.0	135.0	131.0	127.0	123.0	118.0	114.0	110.0	105.0	100.0	
72+00	8.3	120.0	116.0	112.0	107.0	102.0	98.0	93.0	89.0	84.0	
74+00	7.9	118.0	114.0	110.0	106.0	101.0	97.0	92.0	88.0	84.0	
76+00	7.5	129.0	125.0	121.0	117.0	112.0	108.0	104.0	100.0	96.0	
77+90	7.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
79+75	7.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
82+82	11.6	53.0	47.0	41.0	35.0	29.0	23.0	17.0	11.0	5.0	
83+95	11.4	84.0	78.0	72.0	66.0	60.0	54.0	48.0	42.0	36.0	
86+00	11.4	52.0	46.0	40.0	34.0	28.0	22.0	16.0	10.0	4.0	
88+00	11.5	58.0	52.0	46.0	40.0	34.0	28.0	22.0	16.0	10.0	
90+00	11.6	53.0	47.0	41.0	35.0	29.0	23.0	17.0	11.0	5.0	
92+04	11.7	59.0	53.0	47.0	41.0	35.0	29.0	23.0	17.0	11.0	
94+00	11.5	51.0	45.0	39.0	33.0	27.0	21.0	15.0	9.0	3.0	
96+00	11.7	77.0	71.0	65.0	59.0	53.0	47.0	41.0	35.0	29.0	
98+00	6.7	31.0	27.0	23.0	19.0	15.0	11.0	7.0	3.0	0.0	
100+00	6.7	40.0	36.0	32.0	28.0	24.0	20.0	16.0	12.0	8.0	
102+03	6.4	71.0	66.0	61.0	56.0	51.0	46.0	41.0	36.0	31.0	
104+00	6.2	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	
105+82	6.5	41.0	37.0	33.0	29.0	25.0	21.0	17.0	13.0	9.0	
107+82	5.0	36.0	33.0	30.0	27.0	24.0	21.0	18.0	15.0	12.0	



NOTES:
For General Notes, see Sheet No. 1
For Cross Sections, see Sheet No. 1

ATT. 18

REVISION	DATE	DESCRIPTION	BY
U. S. ARMY ENGINEER DISTRICT, NEW YORK CORPS OF ENGINEERS NEW YORK & NEW YORK			
DRAWN BY: D.S.		RARITAN BAY AND SANDY HOOK BAY	
CHECKED BY: A.J.		BEACH EROSION & HURRICANE PROJECT	
DESIGNED BY: Frank J. Fisher		MADISON TOWNSHIP, NEW JERSEY	
SUBMITTED: M. H. Fisher		ADJUSTED BERM WIDTH TABLE	
REVIEWED: Frank J. Fisher		RECOMMENDED: Frank J. Fisher	
APPROVED: M. H. Fisher		SCALE AS SHOWN	
DATE: 7 JUNE 1963		DRAWING NUMBER: CC-RS-220	
		SHEET OF	

**TITLE 33—NAVIGATION AND
NAVIGABLE WATERS**

**Chapter II—Corps of Engineers, War
Department**

**PART 208—FLOOD CONTROL REGULATIONS
MAINTENANCE AND OPERATION OF FLOOD
CONTROL WORKS**

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 53 Stat. 638; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General*. (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times as for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance*. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in times of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation*. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls*—(1) *Maintenance*. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation*. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance*. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, filled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(1) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(II) Inlet and outlet channels are open;

(III) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures—(1) Maintenance.* Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

(I) No parts are missing;

(II) Metal parts are adequately covered with paint;

(III) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced worker to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants—(1) Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways—(1) Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(II) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(III) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition.

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities—(1) Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWFF)

[SEAL]

J. A. ULIO,
Major General,
The Adjutant General.

(R. R. Dec. 44-12225; Filed, August 10, 1944; 9:44 a.m.)

ATTACHMENT 19

SHEET 2 of 2